PHILIPPINE
BUREAU
OF
SCIENCE
—
REPORTS
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1906-12

ELEVENTH ANNUAL REPORT OF THE BUREAU OF SCIENCE

TO THE HONORABLE
THE SECRETARY OF THE INTERIOR

BY

ALVIN J. COX
ACTING DIRECTOR OF THE BUREAU OF SCIENCE

FOR THE YEAR ENDING
AUGUST 1, 1912

MANILA
BUREAU OF PRINTING
1913

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ELEVENTH ANNUAL REPORT OF THE BUREAU OF SCIENCE

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
DEPARTMENT OF THE INTERIOR,
BUREAU OF SCIENCE,
Manila, August 1, 1912.

SIR: I have the honor to submit the following account of the Bureau of Science and the work performed in the Bureau from August 1, 1911, to August 1, 1912, together with a few recommendations with regard to the improvements which seem to me to be necessary.

During the year this Bureau has suffered a terrible loss in the death of Dr. Paul C. Freer. Doctor Freer was appointed superintendent of the Bureau of Government Laboratories when it was organized and later director of the Bureau of Science, as it was called when the Bureau of Mines and that of Ethnology were united with the Bureau of Government Laboratories. A superior intellect and an especially broad training, together with a large endowment of common sense, made Doctor Freer an exceedingly competent leader. The Bureau of Science to-day stands as a monument to his ability. Not only has the Bureau of Science suffered a severe loss, but also the Philippine Islands and the cause of science at large. The following resolutions were passed by the staff of the Bureau of Science:

Whereas it has pleased Almighty God in His Wise and Inscrutable Providence to remove from our midst Paul Caspar Freer, M. D., Ph. D., Director of the Bureau of Science of the Government of the Philippine Islands, since the time of its organization as the Bureau of Government Laboratories in the year 1901, Dean of the College of Medicine and Surgery, and Professor of Chemistry, University of the Philippines, and Founder and Editor-in-Chief of the "Philippine Journal of Science," who, for many years, has been our Leader, Counselor, and Friend, and

Whereas at best we can do little to indicate at this time our real appreciation of him as a man and as a worker for the general good: Therefore be it

Resolved, That we, the Members of the Staff of the Bureau of Science in Manila, Philippine Islands, do hereby express our deepest sorrow and keen feeling of personal loss in the death of Doctor Freer; and be it further

Resolved, That he holds a place of highest respect, admiration and appreciation both officially and personally in the hearts of all of us, and

especially of those who were most intimately associated with him in scientific work; and be it further

Resolved, That it is the sense of the Members of this Institution that the Bureau of Science has suffered a very great loss and that the cause of Science in these Islands has been deprived of one of its most zealous and conscientious advocates; and be it further

Resolved, That we extend our sincere sympathy and condolence to his Widow in her overwhelming grief, to his Sister, Brother, and other Relatives; and be it further

Resolved, That copies of these resolutions be engrossed and sent to the bereaved Widow and Brother of Doctor Freer, and that they be filed in the Archives of the Bureau of Science, transmitted to the Bureau of Civil Service, published in the forthcoming Number of each Section of the "Philippine Journal of Science," in the newspapers of Manila, in a paper in the City of Chicago, Doctor Freer's birth-place, and in "Science," the Official Organ of the American Association for the Advancement of Science, of which Doctor Freer was a fellow.

For the Staff of the Bureau of Science:

[L. S.]

RICHARD P. STRONG,
CHARLES S. BANKS,
E. D. MERRILL,
ALVIN J. COX,
OSCAR TEAGUE,
A. E. SOUTHARD,
Committee.

At Manila, Philippine Islands, this eighteenth day of April, in the year of our Lord one thousand nine hundred and twelve.

On July 1, 1912, this Bureau united with the Philippine Islands Medical Association and the University of the Philippines in a service in commemoration of Doctor Freer. The addresses delivered on this occasion have been published in a special memorial number of the Philippine Journal of Science.

During the last illness and the time subsequent to the death of Doctor Freer, before definite arrangements for carrying on his work were made, the chief of the biological laboratory and the chief of the division of general, inorganic, and physical chemistry, and assistant to the director, directed the affairs of the Bureau. On May 25, the latter was appointed acting director, and the chief of the division of organic chemistry was appointed assistant to the director.

Early in this fiscal year the new wing of the laboratory building was ready to be occupied. The division of mines, the sections of fisheries and ornithology, the entomological collections and laboratories, and the library were moved in. By the end of the last calendar year all of the divisions were well settled except that of entomology which was prevented from putting its quarters in order by the lack of the Skinner cabinets. The Skinner cabinets have been completed by a local firm, but no

PLATE II. DR. PAUL C. FREER, LATE DIRECTOR OF THE BUREAU OF SCIENCE.

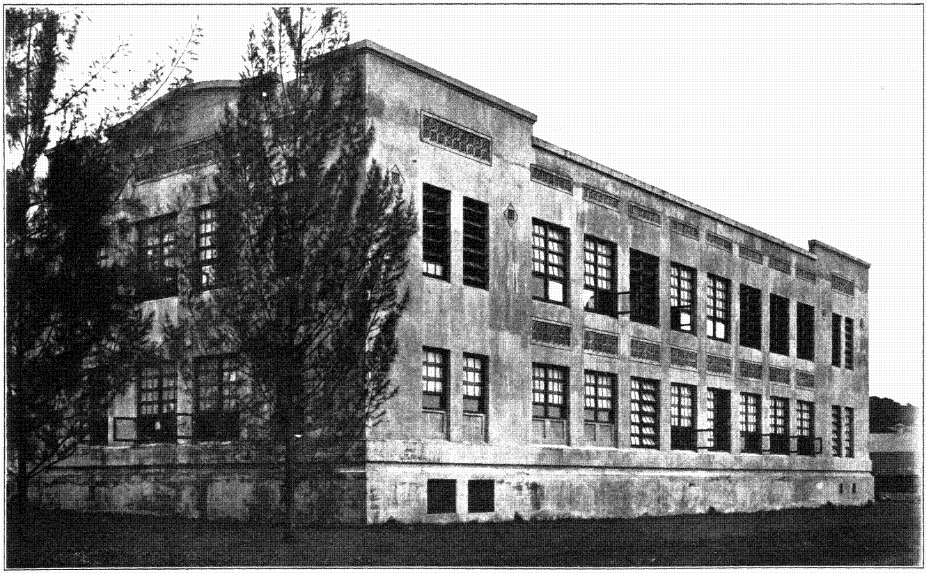

PLATE III. NEW WING, BUREAU OF SCIENCE.

racks for holding them have yet been provided. These will cost about ₱3,000. It was intended that they should be ordered by the Bureau of Public Works from the funds appropriated for the construction of the new wing, but these funds have already been slightly overdrawn. If it were possible to get the material for the construction of these racks, the engineering force of this Bureau could erect the same.

The room in the main building vacated by the library now contains the herbarium of the Bureau of Science which was formerly kept in one room of the lower floor of the biological laboratory and in the lower hallway. The room formerly occupied by the division of mines over the serum laboratory has been equipped to give much-needed office space for the clerical force of the Bureau. The other rooms left vacant by the readjustment have been equipped with laboratory desks, sinks, and hoods, and are now available for laboratory work. Most of these rooms are occupied by the biologists who now have satisfactory quarters. We have been able to give but two additional rooms to the chemical laboratory by this readjustment. These are not sufficient to accommodate the physicists and others from the University to whom the privileges of the laboratory and equipment have been extended. We have two, three, and in one case four men, working on research problems, crowded into a single room.

A large amount of research has been carried on and the results published. The titles of all articles published by members of the Bureau of Science during the year are given in one place under the heading of the Philippine Journal of Science. Following the precedent of the previous years I have, so far as possible, omitted the names of the individual workers and confined myself to the various lines of work which we have performed.

THE BIOLOGICAL LABORATORY

The staff of the Biological Laboratory has been seriously depleted during the past year by the resignation of three of its members and by the detail of several men to other departments of the Government service, as well as by the illness of Dr. R. P. Strong, chief of the biological laboratory, from which he has not yet entirely recovered. Dr. Andrew W. Sellards went on leave to the United States in August, 1911, and has since resigned to accept a position in the hospital of Johns Hopkins University. The resignation of Dr. J. H. Fitzbutler was accepted March 31, 1912. Dr. Oscar Teague, first assistant in the laboratory, went on leave to the United States in June, 1912, handing in his

resignation to take effect at the expiration of his leave, and has accepted a position in the Cornell University Medical School. In addition to these resignations, the following men are on duty in other departments of the Government service. Dr. David G. Willets, the helminthologist of the laboratory, has been detailed to the Philippine General Hospital as resident pathologist. Dr. Bowman C. Crowell has been detailed to the College of Medicine and Surgery of the University of the Philippines, as head of the department of pathology and bacteriology, during the absence on leave of Dr. Vernon L. Andrews. Mr. Ariston M. Guzman has been sent, at the request of the Director of Health, to the quarantine station at Mariveles, to make bacteriological examinations. Five other men in the different sections of the laboratory have been detailed to give courses of instruction in the University of the Philippines.

The vacancies in the staff resulting from these causes and from some previous resignations remain for the most part unfilled. Dr. Otto Schöbl was appointed assistant in March, 1912, and has been put in charge of the routine pathological and clinical examinations. The position of research bacteriologist has been accepted by Dr. John A. Johnston of the Laboratory of Hygiene in the University of Pennsylvania, who is expected to arrive in Manila about November 1, 1912. A helminthologist and an assistant in experimental therapeutics are especially desired on the staff.

ROUTINE WORK

An important change has recently been made in handling routine examinations. Previously, the routine work was divided among a number of more or less competent assistants who were directly responsible to no one. The work is now carried on in two connected laboratory rooms under the direct supervision of Doctor Schöbl. By placing these examinations in charge of a thoroughly capable man who has all the work under his supervision and to whom all of the assistants are directly responsible, it is believed that greater efficiency and accuracy will be secured. Doctor Schöbl, with three temporary assistants, is at present making all of the routine laboratory examinations.

On account of the large amount of laboratory work performed for certain institutions, it has been found convenient and economical to establish branch laboratories at these institutions. Such laboratories have been established at the Philippine General Hospital with Dr. David G. Willets in charge, at Bilibid Hospital, where the work is at present being done by a trained Filipino prisoner under the supervision of a member of the staff

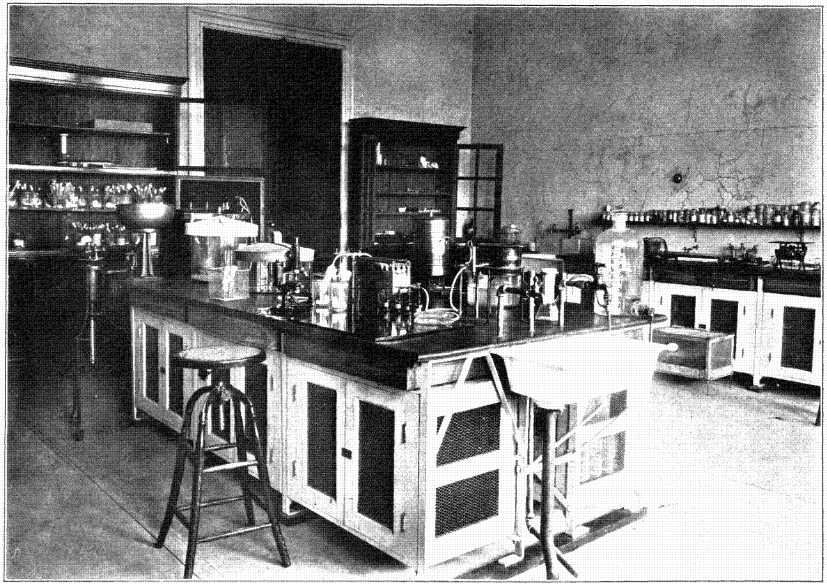

PLATE IV. ROOM IN THE BIOLOGICAL LABORATORY, SHOWING TYPE OF CENTRAL DESK.

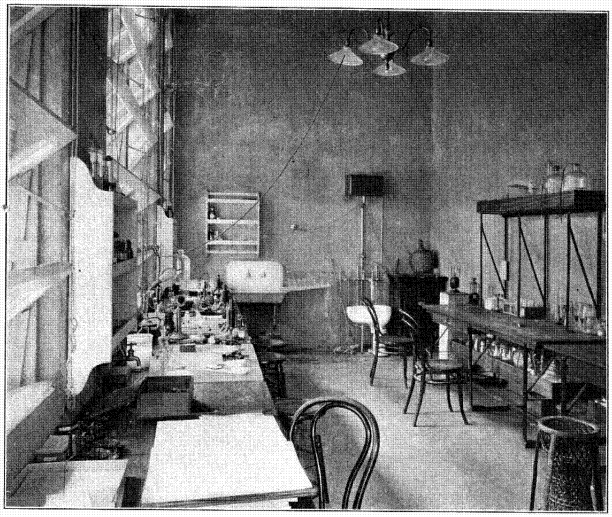

Fig. 1. Branch routine laboratory at the Philippine General Hospital.

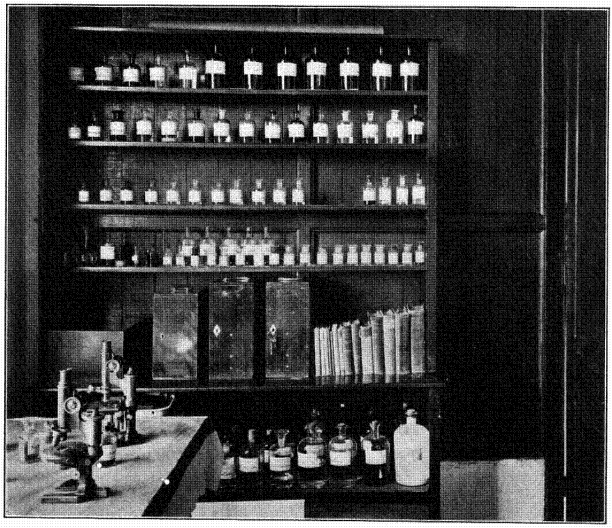

Fig. 2. Branch routine laboratory at Bilibid Prison.

PLATE V.

of the biological laboratory, and at the quarantine station at Mariveles with Mr. Ariston M. Guzman in charge. On each of the five trips made by the Bureau of Health for the purpose of collecting lepers, one or two men have been detailed from the biological laboratory to make the bacteriological diagnoses.

The following table shows the number of routine examinations made by the laboratory during the present and preceding year, and the increase for the year of 45 per cent over the number made during the preceding year:

Nature of examination.	1911	1912
Fæces	14,223	22,733
Sputum	780	3,925
Blood	275	3,951
Gonococci	13,997	15,971
Waters	360	742
Necropsies	238	59
Miscellaneous	5,772	4,564
Total	35,645	51,941

INVESTIGATIONS

Plague.—The proceedings of the International Plague Conference held at Mukden in 1911, of which Doctor Strong and Doctor Teague were members, has been printed by the Bureau of Printing of the Government of the Philippine Islands. Cultures and pathological material brought from Manchuria have served for an extended study of the pathology, epidemiology, prophylaxis, and immunity of pneumonic plague by the staff of the laboratory. Section B, number 3, of the Philippine Journal of Science for this year will be made up of the results of these investigations. The number consists of the following twelve articles:

STUDIES ON PNEUMONIC PLAGUE AND PLAGUE IMMUNIZATION

I. Introduction. The expedition to Manchuria and the conditions under which the work was performed there.
II. The method of transmission of the infection in pneumonic plague and manner of spread of the disease during the epidemic.
III. Influence of atmospheric temperature upon the spread of pneumonic plague.
IV. Portal of entry of infection and method of development of the lesions in pneumonic and primary septicæmic plague. Experimental pathology.
V. Clinical observations.
VI. Bacteriology.
VII. Pathology.
VIII. Susceptibility of animals to pneumonic plague.

IX. Protective inoculation against pneumonic plague.
X. Immunization of guinea pigs by vaccination with avirulent plague bacilli mixed with agar.
XI. The infection of guinea pigs, monkeys, and rats with doses of plague bacilli ranging from one bacillus upwards.
XII. Some experiments to determine the efficacy of various masks for protection against pneumonic plague.

Beriberi.—An extensive series of experiments has been conducted at Bilibid Prison to determine the influence of various diets on the production of beriberi. The different varieties of rice were the chief constituents of these diets. These investigations, which supply the first experimental evidence bearing on the etiology of polyneuritis in man, are being prepared for publication, and will eventually appear in the Philippine Journal of Science.

Entamœbic dysentery.—The investigation of entamœbic dysentery has been continued during the year. A large series of feeding experiments with the species of amœba and entamœba that might be concerned in the etiology of entamœbic dysentery has been made upon man, and these, together with a careful morphological study of amœbæ, have demonstrated that the cultivable amœbæ, those common to surface-water supplies, are neither parasitic nor pathogenic; that *Entamœba coli* is parasitic, but not pathogenic; and that *Entamœba hystolytica* is both parasitic and pathogenic to man. The amœbæ that live in surface water are incapable of living as parasites in the intestines of man, and consequently are not concerned in the production of dysentery. The direct or indirect sources of all infections in amœbic dysentery are the existing cases. A report upon some of this work has been published in the Philippine Journal of Science.

Surra.—The investigation of surra has been continued during the year, and one paper on the schizogony of *Trypanosoma evansi* in the spleen of the vertebrate host has been published in the Philippine Journal of Science.

Pathology.—In addition to the work on the histology of pneumonic plague and of beriberi described under those heads, papers on Addison's disease and adrenal tuberculosis and on mucocele and diverticulum of the vermiform appendix of inflammatory origin have been completed and published. Investigation of nonparasitic cysts of the liver has been carried on and is in preparation for publication. The detail of the pathologist to the College of Medicine and Surgery has interrupted this research work.

The outbreak of dysentery at Baguio.—On March 5, 1912, Doctor Barber and assistant were detailed to investigate the outbreak of dysentery at Baguio. The laboratory work was done at Government Center and at the Civil Hospital in Baguio. About 20 cases were examined, and 13 of these were shown by the bacteriological diagnosis to be bacillary dysentery. Infections with both the Shiga and the Flexner varieties of *Bacillus dysenteriæ* were encountered. Sources of water supply were inspected, and repeated examinations were made of waters used for drinking and domestic purposes. Septic tanks and other sewage systems were inspected. Breeding places of flies were noted and reported. Frequent visits were made to Igorot railway construction camps where dysentery was epidemic. A journey of six days was made to various Igorot villages, especially near Baguio and to the northward, to look up reported cases of dysentery. The results of this investigation will be published in the Bulletin of the Manila Medical Society.

Diseases prevalent in the Batanes Islands.—During the months of April and May the general conditions affecting the public health and the diseases which have previously occurred and those now prevalent in the Batanes Islands were investigated by Doctor Willets, and such assistance as possible was rendered. Dispensaries were opened in Santo Domingo de Basco and in Mahatao on Batan Island, in Sabtang on Sabtang Island, and in Itbayat and Raile on Itbayat Island, and about 250 persons presented themselves for treatment.

Virulent bronchitis, tuberculosis, skin diseases, rheumatism, and Bright's disease were found to be common. One hundred per cent of 400 natives examined harbored intestinal worms. An epidemic of measles was encountered. Dysentery was infrequent. Venereal diseases were rare. No cases of yaws, beriberi, paragonimiasis, elephantiasis, or leprosy were seen, but the last has previously existed here. No histories suggestive of typhoid were obtained. Chickenpox occurred several years ago; cholera, in 1902; smallpox, in 1896. Between 15 and 20 surgical cases were seen.

Sera and vaccines.—The preparation of variola vaccine (vaccine virus) was continued throughout the year. Cholera prophylactic, plague prophylactic, gonococcus vaccine, staphylococcus vaccine, and typhoid vaccine were prepared in moderate quantities. Anthrax vaccine, tuberculin (both human and bovine), and mallein were continually kept on hand.

Antidiphtheritic, antitetanic, anticholera, antityphoid, antiplague, and antidysenteric sera were made in quantities sufficient to supply the demand.

Typhoid, paratyphoid, and cholera reagents (killed cultures) for agglutination; agglutinating sera in liquid and dried form, for the purpose of diagnosing infectious diseases and identifying bacteria; as well as normal sera of horse, ox, sheep, and goat were always kept on hand. Other sera, such as those of dog, cat, rabbit, and guinea pig, are supplied on request. Sterile blood or washed blood-corpuscles of horse, ox, sheep, goat, rabbit, and guinea pig are also furnished on request.

Since August, 1911, 1,050 serum tests for syphilis were made.

Rabies.—The work on rabies was continued throughout the year. Thirty-four patients reported at the Bureau of Science for treatment, and glycerinated material was sent out for 5 patients. Eleven dogs were submitted for examination; Negri bodies were demonstrated in the brains of 8 of these. A woman died at San Lazaro Hospital October 7, 1911. Negri bodies were found in the hippocampus major of the woman. Two rabbits were inoculated subdurally with an emulsion of the woman's brain; they died on the nineteenth day after inoculation, and Negri bodies were found in their brains.

The investigation in connection with the serum laboratory on passive immunity against tetanus toxin is still being continued.

THE BOTANICAL SECTION OF THE BIOLOGICAL LABORATORY

Personnel.—Dr. C. B. Robinson, economic botanist, resigned in the early part of the year, his resignation to take effect August 18, 1911. This left Mr. E. D. Merrill as the only botanist pending the arrival of the newly appointed men from the United States. Dr. W. H. Brown was appointed as physiologist and Mr. P. W. Graff as mycologist, the former reporting for duty on October 8, 1911, and the latter on October 16, 1911.

Routine work.—Work of this nature has been similar to that in previous years. No large distribution of duplicates has been made, as it has been impossible, with the available assistance, to make up the sets. A total of 13,396 specimens have been poisoned, mounted, and for the most part distributed into the herbarium, while approximately 14,431 duplicate specimens have been distributed for all purposes; exchanges, for determination, etc.; and 702 mounted sheets have been loaned. In the course of the year over 6,000 specimens have been determined, for the most part material destined for the herbarium of the Bureau,

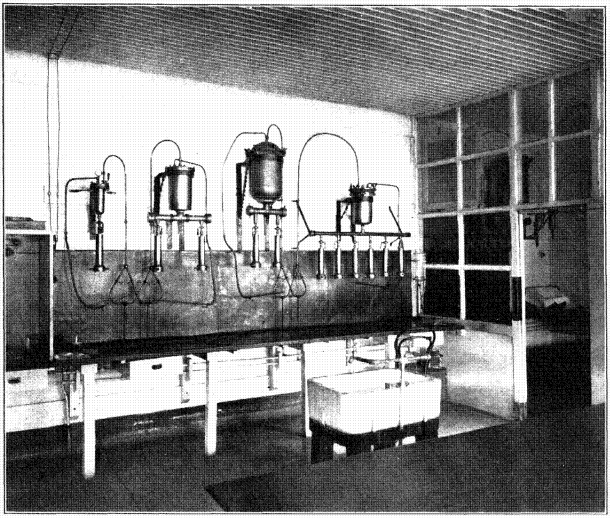

Fig. 1. Interior of the room for filtering serum.

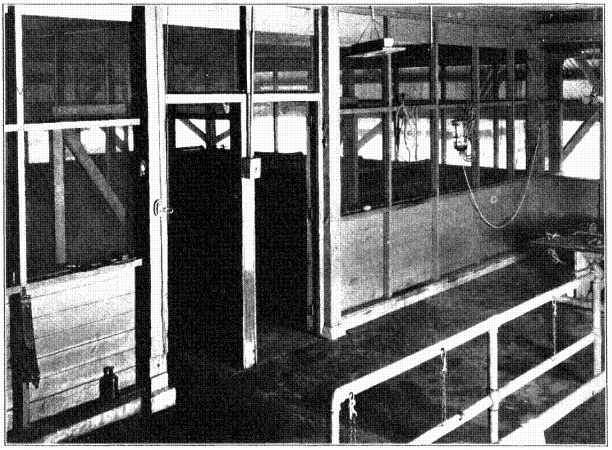

Fig. 2. Interior of the stable for serum animals.

PLATE VI.

but including a quantity of miscellaneous determinations for the Bureau of Education, the Bureau of Agriculture, the College of Agriculture, and for various collectors.

The herbarium.—This most important adjunct to the botanical work has shown a satisfactory growth. A total of 13,396 mounted sheets have been added during the past year from the following sources:

Collections of—	
Bureau of Science employees	2,227
Bureau of Forestry employees	578
Miscellaneous Philippine material	2,589
Extra-Philippine material received by gift, exchange, and special collections	8,002
Total	13,396

Of the Philippine collections, the miscellaneous material enumerated above was from the following collectors:

Father M. Vanoverbergh	129
Father F. Sanchez	19
C. M. Weber	614
R. M. Holman	192
A. D. E. Elmer	1,314
F. R. Bona	99
J. P. Eskridge	18
E. D. Merrill, Century 11, Philippine Plants	100
Miscellaneous	104
Total	2,589

The extra-Philippine material received in the past year in exchange and by special collection has been of exceptional value, the accessions from this source exceeding those of any previous year since the establishment of the institution both in extent and in value of the material received.

Mr. H. M. Curran, Hawaiian plants, presented	200
Herbarium of Prince Roland Bonaparte, Paris, France, by exchange	765
Royal Botanic Garden, Calcutta, Indian plants	186
Museum of Natural History, Paris, France, chiefly plants of Indo-China and China	1,203
F. A. G. Kerr, Siam plants, through Dr. F. W. Foxworthy	6
Hawaiian plants, coll. Forbes, through H. M. Curran	5
Dr. R. Schlechter, Malayan orchids and Asclepidaceae	122
Australian plants, ex. Herb. Sydney	100
Rijks Herbarium, Leiden, Holland, exchange	312
U. S. Department of Agriculture, cultivated plants	145
Boissier Herbarium, Geneva, Switzerland, European plants	882
British Museum, Natural History, Indian plants	1,540

C. B. Robinson, Hongkong plants, presented	31
E. B. Copeland, ferns presented	9
Miscellaneous	60
Borneo plants, native collectors, Bureau of Science	1,659
Guam plants:	
Collection of R. C. McGregor, Bureau of Science	232
Collection of Mary Strong Clemens	37
Collection of J. B. Thompson	25
Collection of Guam Experiment Station	484
Total extra-Philippine material	8,002

The large and valuable Bornean collection was made by a native collector, kindly employed and supervised for the Bureau of Science by Mr. J. C. Moulton, director of the Sarawak Museum, Kuching, Sarawak, Borneo. Most of the numbers are represented by duplicate material. The Guam collections are for the most part due to the interest shown by Mr. J. B. Thompson, special agent in charge of the Guam Experiment Station. He suggested that a collector be sent to Guam, but as none was available at the time transportation was to be had, Mr. R. C. McGregor volunteered to go, spending about three weeks in the field in Guam in November, 1911, and in that time training a native collector who has continued the botanical collection.

We are especially fortunate in having secured much historical material from early Indo-Malayan collections, such as those of Hooker and Thompson, C. B. Clarke, Pierre, Junghuhn, Korthals, Delavay, Farges, Thorel, Harmand, and Verreaux—collections made many years ago, and the duplicates, for the most part long since distributed. Very many of the specimens in these collections are cotypes; that is, duplicates of plants on which original descriptions have been based; and still more of them are historical specimens; that is, those that have been cited in botanical literature by various authors. This recently acquired material, together with that previously secured from various European institutions, gives the herbarium of the Bureau of Science a relatively high percentage of historical material.

The total number of mounted specimens now in the herbarium is 106,579, of which about 66,500 are Philippine, the remainder extra-Philippine.

The herbarium of the Bureau of Science represents an asset that is difficult to estimate in the terms of dollars and cents. From a commercial standpoint it must be appraised for at least ₱20,000, and is constantly increasing in value. From a scien-

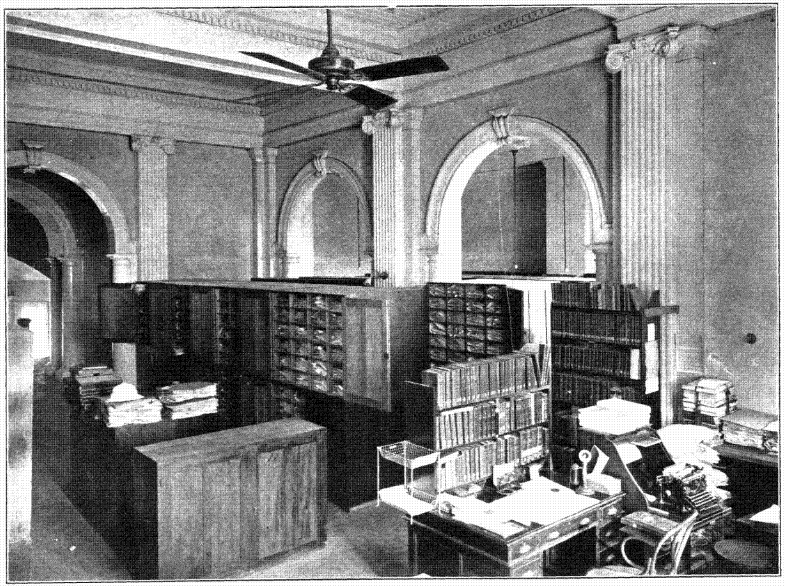

PLATE VII. INTERIOR OF HERBARIUM, SHOWING TYPE OF CASES.

tific standpoint it is quite impossible to estimate the value of the collection. Among the 100,000 specimens now preserved in the herbarium are several thousand types and cotypes; types or cotypes of most of the Philippine species described in the past ten years are preserved in the collection.

Loans and distribution of duplicates.—Material in duplicate has been sent to specialists either for determination or for verification of our determinations as follows:

Ferns to Dr. E. B. Copeland, College of Agriculture, Los Baños	675
Mosses to Dr. V. F. Brotherus, Helsingfors, Finland	346
Hepaticae to Herr F. Stephani, Leipzig, Germany	151
Lichens to Dr. E. A. Wainio, Helsingfors, Finland	376
Asclepiadaceae to Dr. R. Schlechter, Berlin, Germany	45
Characeae to Messrs. H. & J. Groves, London, England	20
Orchidaceae to Mr. Oakes Ames, North Easton, Mass.	380
Selaginella to Dr. G. Hieronymus, Berlin, Germany	92
Gesneriaceae to Dr. Fr. Kränzlin, Berlin, Germany	47
Sapindaceae to Dr. L. Radlkofer, Munich, Germany	48
Araceae to Dr. A. Engler, Berlin, Germany	51
Symplocaceae to Dr. A. Brand, Sorau, Germany	11
Piperaceae to C. DeCandolle, Geneva, Switzerland	69
Palmae to Dr. O. Beccari, Italy	51
Pandanaceae to Dr. U. Martelli, Florence, Italy	61
Cyperaceae to Rev. G. Kükenthal, Coburg, Germany	173
Menispermaceae to Dr. L. Diels, Marburg, Germany	17
Nepenthaceae to Dr. J. M. MacFarlane, Philadelphia, Pa.	11
Monimiaceae to Dr. J. Perkins, Berlin, Germany	3
Bambusae to J. Sykes, Samble, East Liss, Hants, England	21
Dioscoreaceae to I. H. Burkill, Calcutta, India	26
Total	2,674

Mounted specimens belonging to the herbarium loaned to specialists in the past twelve months, either on request of those who are monographing various groups or for use in determining our Philippine material, are as follows:

Pandanaceae to Dr. U. Martelli, Florence, Italy	6
Nepenthaceae to J. N. MacFarlane, Philadelphia, Pa.	5
Dioscoreaceae to I. H. Burkill, Calcutta, India	13
Araceae to Dr. A. Engler, Berlin, Germany	10
Gesneriaceae to Dr. Fr. Kränzlin, Berlin, Germany	29
Symplocaceae to Dr. A. Brand, Sorau, Germany	21
Piperaceae to C. DeCandolle, Geneva, Switzerland	12
Asclepiadaceae to Dr. R. Schlechter, Berlin, Germany	98
Orchidaceae to Mr. Oakes Ames, North Easton, Mass.	506
Leguminosae to S. T. Dunn, Kew, England	2
Total	702

As noted above, no large distribution of duplicate material has been made during the year, but the following specimens have been sent out on our general exchange account:

Mexican plants to the U. S. National Museum	100
Brazilian plants to the N. Y. Botanical Garden	336
New Zealand plants to the U. S. Dept. Agriculture	25
New Zealand plants to the Gray Herbarium, Cambridge, Mass.	55
New Zealand plants to the Missouri Botanical Garden	110
Philippine orchids to Dr. R. Schlechter, Berlin, Germany	29
Seven species of grasses and sedges, 120 specimens each, to G. Kneucker, Karlsruhe, Germany	840
Centuries 5 to 10, Philippine Plants, 15 sets each to Herr T. O. Weigel, Leipzig, Germany, on book exchange	9,000
Fungi to Mr. C. G. Lloyd, Cincinnati, Ohio	60
Fungi to Herr P. Sydow, Berlin, Germany, for distribution in his fungi exotici, 20 species, about 60 specimens each	1,200
Miscellaneous material	2
Total	11,757

The special exchange of botanical material entered into with Herr T. O. Weigel of Leipzig has been the means of adding to the library of the Bureau of Science many valuable books, which, with the limited funds available, it was impossible to secure otherwise. Four centuries of 15 sets each were prepared and forwarded in the preceding year, and during the past fiscal year 6 additional centuries of 15 sets each were sent. Orders have been placed which, if all publications desired are available, will cover the amount credited to the Bureau, and many of the books have already been received.

In connection with assistance given to the authorities of the city of Manila in securing plants and seeds for the city, the "Catalogue of Plants Cultivated in the City Nursery at the Cementerio del Norte" has been entirely rewritten and some photographic illustrations added, and submitted to Mr. J. C. Mehan for publication. This work contains very brief descriptions of about 350 species of plants, mostly ornamental, at present cultivated in the city nursery, and is in the nature of a descriptive catalogue, the species being arranged by genera and families, with common names, origin, etc.

The Bureau of Science is now in exchange relations with about fifty institutions and individuals in various parts of the world, duplicates of Philippine plants being supplied by this office in exchange for extra-Philippine material, preferably plants from the Tropics. In the past year additional exchanges have been arranged with the Government Museum, Taihoku, For-

mosa, for Formosan plants; with Dr. H. Winkler, Breslau, Germany, for Bornean plants; with the Imperial Forest Research Institute and College, Dehra Dun, India, for Indian plants; with Mr. T. Petch, Peradeniya, Ceylon, for Ceylon fungi; with Mr. C. G. Lloyd, Cincinnati, Ohio, for fungi; and with Dr. H. Sydow, Berlin, Germany, for fungi.

Publications.—The section of botany is responsible for Section C, Botany, of the Philippine Journal of Science. A list of the articles published during the fiscal year is given elsewhere. A number of papers are in press, and still others in preparation. Aside from the papers destined for publication in the Philippine Journal of Science, an extensive manuscript, entitled "A Flora of Manila," has been completed and sent to press for publication in the special series of the Bureau of Science. Work on this paper was prosecuted at intervals over a period of two years. It contains the detailed description of a little over 1,000 species with generic and family descriptions, analytical keys to the families, genera, and species, glossary, etc., and should prove to be the most generally valuable botanical publication issued from the Bureau.

Investigations.—Mr. Elmer D. Merrill, chief of this section, has a number of papers in preparation on taxonomy of Philippine plants. He plans also ultimately to publish on the Guam and Bornean collections recently received. In connection with the taxonomic investigations, considerable attention is being given to questions of geographical distribution. In pursuance of the plan of coöperation between the Bureau of Science and the University of the Philippines, Mr. E. D. Merrill has been detailed for a portion of his time to the University and appointed associate professor of botany and acting head of the department, the appointment effective July 1, 1912. The disadvantage of the plan is that less time will be available for investigation, and that extended personal field work will be impracticable except during vacations. The advantage will be largely in the centralization of the botanical work. In the immediate future a considerable part of his time each day will be taken with the duties of instruction, supervision, etc.

Doctor Brown has finished an investigation of the mechanism of movement of the leaves of the sensitive plant, *Mimosa pudica,* and has also investigated the relation of the interesting parasitic plant, *Rafflessia manillana* Teschem., to its host, *Cissus,* with a view to the condition and effect of the vegetative cells of the parasite in the tissues of the host, method and effect of growth

of the flower, and the relations of the tissues of the parasite to those of the host. Doctor Brown and Mr. Graff are working on the problem presented by the fungus successions on dung cultures which may yield interesting results.

A more extended problem, on which work is in progress, is the relation of the distribution of vegetation on Mount Maquiling to environmental conditions. The outline of work has been completed, stations selected, and apparatus secured. Environmental factors will be measured for one year, to include temperature of air and soil, light intensity, rainfall, humidity, evaporation, and soil moisture. Transpiration and other functions of plants will also be measured, and especial attention will be given to the effect of different environments on the same plant. An employee of the Bureau of Forestry will coöperate with Doctor Brown on a number of problems associated with Philippine forestry.

Work is also being done on the problem of transpiration of plants under tropical conditions, on the effect of different seasons and times of day, on the water content of plants and the relation of this to growth.

Considerable work has been done on the mycological collections, determining accumulated material, selecting the herbarium set, mounting the specimens, and segregating the duplicates for exchange purposes. An attempt is being made to build up the mycological collections both in Philippine and in extra-Philippine material. Several outbreaks of sugar-cane diseases have been investigated, and remedial measures recommended. An apparently serious, and perhaps new, disease of the banana has appeared at Lamao, which is now being investigated. Cultural experiments appear to show that it is of a bacteriological nature.

Field work.—During the past year no very definite plan of exploration has been followed. So far as practicable an attempt has been made to keep at least one collector in the field all the time.

It is our aim to send collectors into regions previously botanically unexplored. With the enormous areas in the Philippines as yet unknown or only very imperfectly known botanically, it will be the work of very many years before our collections adequately represent the flora of the Archipelago. The percentage of novelties in current collections is still very high, and collections made in what are considered botanically well-known regions show many new forms.

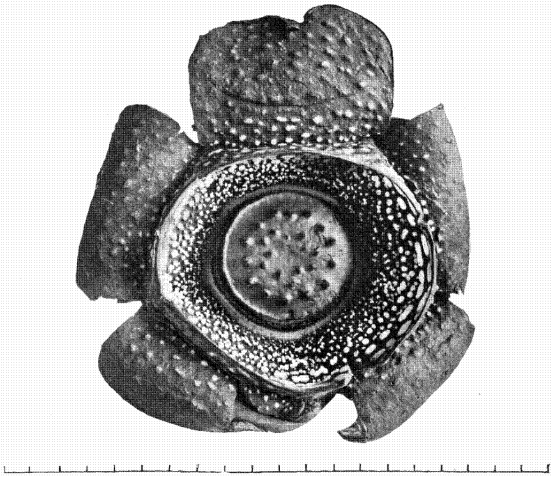

Fig. 1. Male flower.

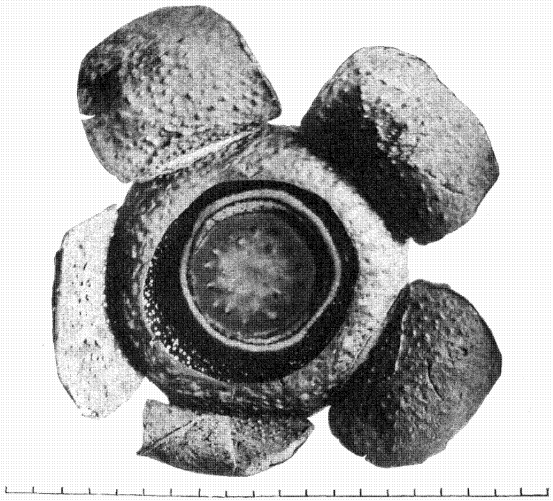

Fig. 2. Female flower.

PLATE VIII. RAFFLESIA MANILLANA Teschem.

THE ENTOMOLOGICAL SECTION OF THE BIOLOGICAL LABORATORY

Mr. Schultze returned from Europe in November, 1911, with a large quantity of identified material and several manuscripts prepared by German specialists, and he has done much of the work of preparing the latter for publication.

In the month of May, 1912, Mr. C. R. Jones transferred to the Bureau of Agriculture to do entomological work in connection with locusts. This transfer is unfortunate as Mr. Jones had gained sufficient experience in the Philippines to make his service particularly valuable to this Bureau.

Routine work.—A large amount of purely routine work, such as, the determination of injurious and other insects both for individuals and for other bureaus of the Government, in suggesting methods of combating the common pests of household and farm, in giving both oral and written information as to silk culture and its possibilities to those who have usually applied in person, in the mounting and accessioning of material collected or donated, and in the general care of a large and rapidly growing collection of Philippine insect fauna, has been performed.

Accessions.—The accession numbers for the last year begin with 14,407, and 2,250 lots or approximately 11,250 insect specimens ready for study, sale, exchange, or other disposition were added, showing an increase over the previous year of some 5,750 specimens. This does not represent the actual material acquired. About three times as many specimens are stored awaiting accession. The material collected comprises many forms hitherto not contained in our collection.

Donations.—Mr. C. M. Weber has donated a considerable number of insects collected by him at various times and places during the past year, many very desirable specimens having been taken in Mindanao during his orchid-collecting trips. Prof. R. Thaxter donated certain insects affected by fungus and also normal specimens which had been collected for him by Mr. Weber in Mindanao. Rue Preston has collected a considerable amount of material in the vicinity of Baguio. Many other individuals have donated single specimens to the collection during the year.

Exchanges and sales.—Our price and exchange list was sent out early in 1911, but we have not had as numerous responses as were anticipated.

A native collector who could devote his time to getting desiderata asked for by scientists in other parts of the world would

enable us to obtain without delay things that we may not, at the time, have in our collection. It would also enable us to lower our prices for material which we could sell in quantity. With a good man constantly collecting, we could establish a system of supply somewhat similar to that at Naples and eventually make it a paying proposition.

Identificaton of material.—This work has been done by Mr. Banks, by Mr. Schultze during his trip last year to Europe, and particularly by coworkers in Europe who have assisted both in the identification of material and in the preparation of papers for publication. The preparation of catalogues of Philippine Coleoptera and Hemiptera is in progress.

The first 500 of a total of 2,000 insect boxes have arrived and will be available for use as soon as the steel racks to hold the 74 Skinner cabinets are put in place in the collection room.

Instruction work.—Mr. Banks has continued his work of teaching medical entomology in the College of Medicine and Surgery in the University, having had a class two days per week during the first semester.

Silk culture.—The necessity for a thoroughly trained individual to give his entire time to silk culture and its propaganda in the Philippines becomes more apparent every year. We need also to ascertain the best races of silkworms to introduce and cross with our own, in order to retain our silkworms in vigor and free from danger of disease.

Mosquito extermination in Manila.—The work of the antimosquito brigade has gone on very satisfactorily during the past year. It consists of a force of 25 men under an American sanitary inspector, but this is not sufficient to cope with periodical outbreaks of certain mosquitoes, the abundance of which depends upon conditions brought about in the course of public and private improvements and the prevalence at certain times of the year of exceedingly high tides which flood land normally not under water.

Baguio fly and mosquito campaign.—Just before the opening of the Baguio season this year Mr. Banks was sent to the mountain capital to investigate the mosquito problem with a view to lessening the numbers of this pest at that resort. Upon arrival it was evident that a more serious menace to health and comfort was present in the overwhelming plague of flies in that city. Steps were at once taken to get the situation outlined with a view to fly eradication, and the Philippine Commis-

PLATE IX. ONE OF THE ENTOMOLOGY ROOMS.

Fig. 1. Interior of the silk-house, showing ant-proof racks for the silkworms.

Fig. 2. A corner of the room for marine biology, showing some of the aquaria and museum shelves.

PLATE X.

sion appropriated ₱10,000 with which to inaugurate a campaign against flies, mosquitoes, and other disease-bearing pests.

The active campaign which started March 16 and was continued until April 15 was remarkably successful. In order to be of permanent value, this work must be continued with a certain degree of system in the future.

Investigations.—Insects which breed in horse manure and other excreta have been studied. The biology of Philippine Culicidae has been continued. A series of experiments in the treatment of tobacco and cigars with a view to the lessening of the ravages of the cigarette beetle (*Lasioderma serricorne*) in this product have been carried on, and results will soon be published in the Philippine Journal of Science. The insects attacking the castor oil plant, valuable in the Philippines because of the possibility of its use as a food plant for the Eri silkworm, have received attention.

THE SECTION OF FISHERIES OF THE BIOLOGICAL LABORATORY

The new wing of the Bureau has provided this section with greatly improved facilities for work. The collection has been rearranged and relabeled with printed labels which were pasted on and paraffined to prevent insects from eating them. The specimens cannot all be put on the shelves until new jars arrive. The collection is in first-class condition and is well arranged for study.

Economic work.—During the past year especial attention has been given to economic fishery work. Papers relating to shells used in the manufacture of buttons, window shells, tortoise shell, trepang, the shark-fin industry, and the manufacturing of leather from skins of marine animals were published in the Philippine Journal of Science. These papers show that several small, but profitable, fishery industries could be inaugurated in the Philippines. A paper on the common edible mollusks sold in the Manila market is finished and awaiting publication. The need of additional careful work, especially on the life histories of our commercial shells and on trepang, is pointed out. A report giving short descriptions and figures of the poisonous fishes of the Philippines was written some time ago and is ready for the press.

During the year experiments in drying, kippering, refrigerating, marinading, and otherwise preserving various fish products have been carried on. The fact that we now have running salt

water in the fisheries room will enable us to work out many important economic problems relating to the propagation and habits of certain of our marine forms, especially such as relate to the pearl oysters, the commercial shells, and the trepang, all of which are worth our most careful study.

Game fishes.—The interest in the game fishes of the Islands has increased to a marked degree, and numerous fine specimens have been captured during the year. One of the most important catches made, both from the sportsman's and scientific standpoint, was a 65-pound Spanish mackerel caught by the Honorable Dean C. Worcester off the coast of Leyte. This fish proved to be a new species of *Acanthocybium*. A complete record of the game fishes of the Islands is being kept, and the location of all catches is recorded and plotted on a map.

Fish culture.—Upon the arrival of the new McDonald hatching jars, experiment will be inaugurated on hatching various fishes and mollusks. The black bass ponds of Baguio were inspected during the early part of the season, and all were found in good condition, a large stock of young bass being observed in each of the ponds. The dam built at Haight's place was destroyed by a typhoon, and all the fishes escaped into the upper reaches of the river. It is possible that they may serve to stock some of the tributary streams. Some parts of the Trinidad River were found to contain bass, probably resulting from the overflow of Trinidad Lake or possibly from the original stock placed in the stream. A large collection of fishes from Hongkong was identified, and several new species described. This work is not quite complete. A collection of fishes was identified for the College of Agriculture at Los Baños. A large collection, containing a number of new species, has been secured at Port Galera where Mr. Seale spent the summer. In all, more than 2,000 specimens have been added to the fishery collection during the year. At Port Galera considerable time was given to the study of the spawning season and habits and to collecting specimens of the very young of a number of our most important food fishes.

The work of the section of fisheries could advantageously be extended were funds available for the employment of an additional fish expert trained in economic fishery work. Next to agriculture, fishing is the most important industry and supplies more people with food than any other occupation in the Islands. It is very desirable that the condition of the fisheries be improved and the fishing banks mapped. The need of such work has been amply demonstrated during the past year in the failure of a

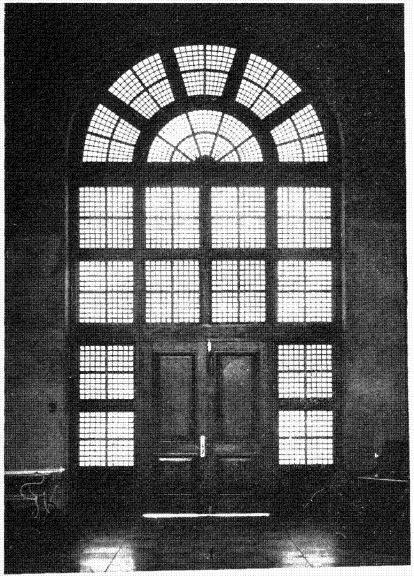

Fig. 1. Shell window in the new Philippine General Hospital.

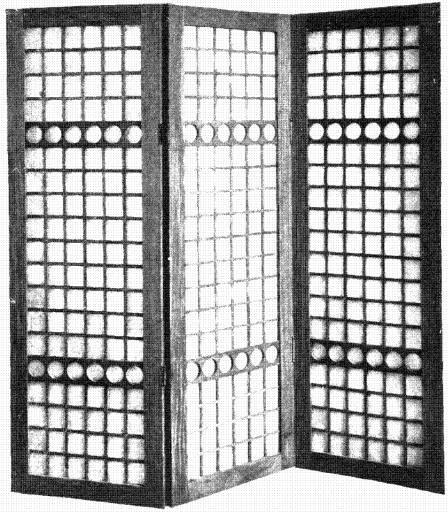

Fig. 2. Screen made of window shell and red narra wood.

PLATE XI. UTILIZING PHILIPPINE WINDOW SHELL.

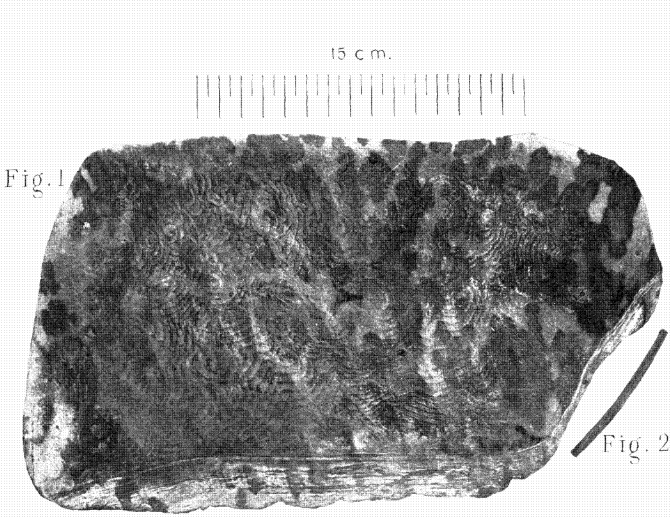

Fig. 1. Plate from the hawksbill turtle.
Fig. 2. Section showing thickness of the above plate.

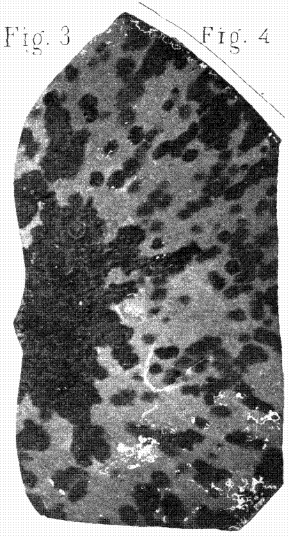

Fig. 3. Plate from the green turtle.
Fig. 4. Section showing thickness of the green turtle shell.

PLATE XII. PHILIPPINE TORTOISE SHELL.

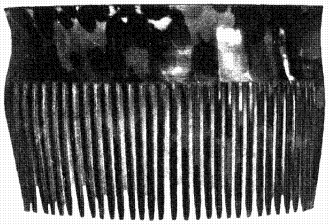

Fig. 1.

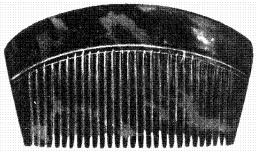

Fig. 4.

Fig. 2.

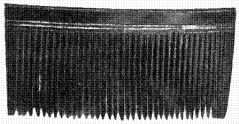

Fig. 5.

Fig. 3.

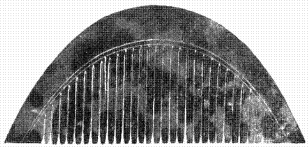

Fig. 6.

PLATE XIII. COMBS MADE IN MANILA FROM PHILIPPINE TORTOISE SHELL.

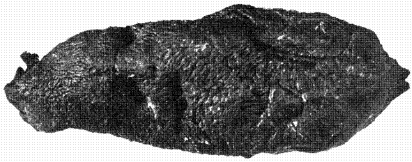

Fig. 1. The oe.

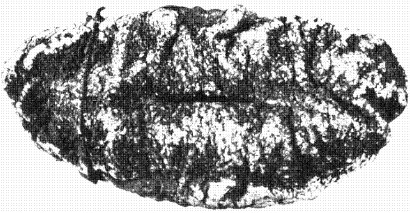

Fig. 2. The gan sim.

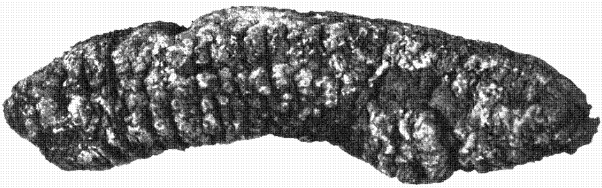

Fig. 3. The bark sim.

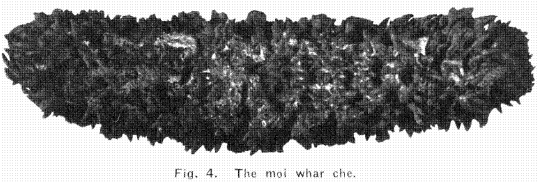

Fig. 4. The moi whar che.

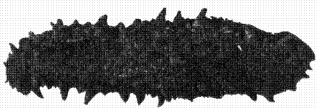

Fig. 5. The hong che.

PLATE XIV. PHILIPPINE TREPANG.

Fig. 1. Dried shark-fin prepared for export.

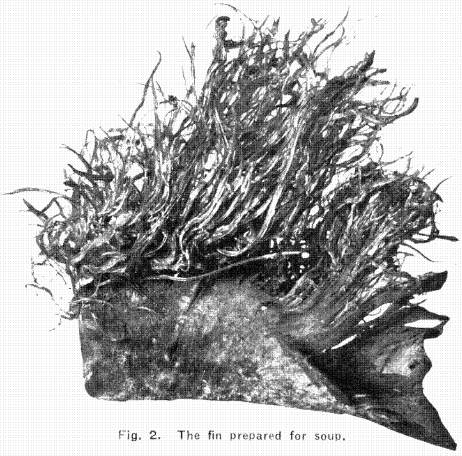

Fig. 2. The fin prepared for soup.

PLATE XV. PHILIPPINE SHARK-FIN.

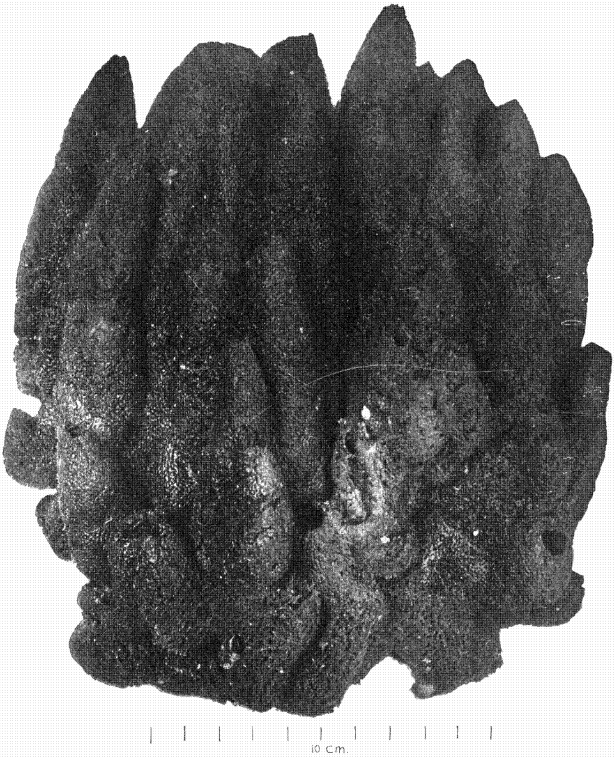

PLATE XVI. A PHILIPPINE COMMERCIAL SPONGE IN ITS NATURAL STATE.

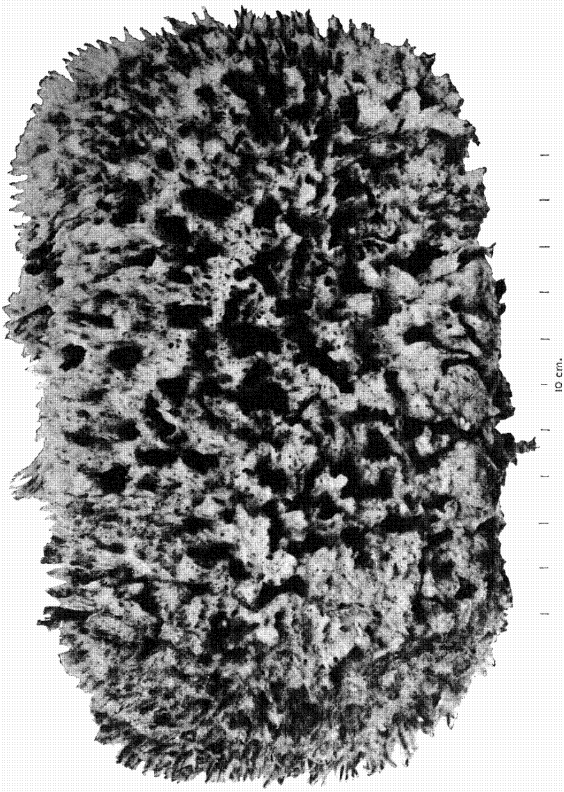

PLATE XVII. THE PHILIPPINE SHEEP'S-WOOL SPONGE.

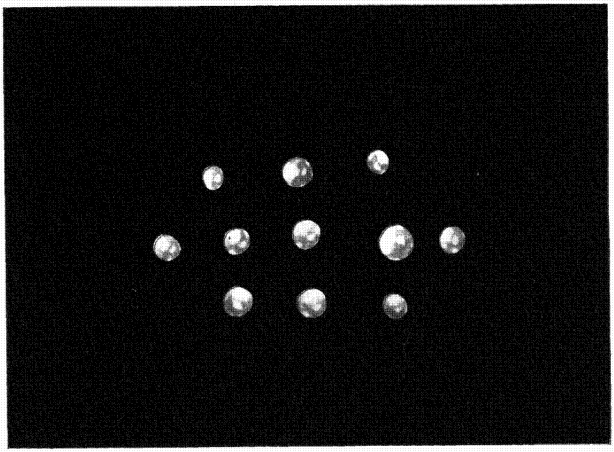

Fig. 1. Culture pearls from the pearl farm in the Bay of Ago, Japan.

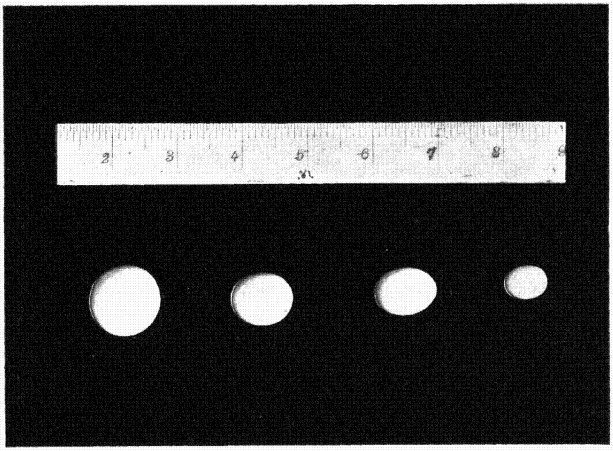

Fig. 2. Pearls found at Siasi Island in taclobo shells.

PLATE XVIII.

steam trawler because she lost so much time and gear in prospecting for suitable trawling banks. It is probable that much difficulty will be experienced in getting capital to engage in the deep-sea-fishing industry in the Philippines until this work has been performed.

We are in great need of a fish pond, where experiments for improving fish farming and shellfish industries may receive some much-needed attention.

With the opening of the aquarium, it will be necessary to establish two or three small fishery stations for securing material. One of these should be near the mouth of Manila Bay with daily transportation to Manila; the other should be at Cebu; a third might be at Subig Bay. When good steamer connections can be had with Port Galera, that place will be a good base of supply.

THE SECTION OF COLLECTION OF NATURAL HISTORY SPECIMENS OF THE BIOLOGICAL LABORATORY

The ornithological collections have been transferred to commodious quarters in the new wing. This change affords ample room for the study series of birds, wall space for the display of mounted specimens, convenient desks and book cases, and a place for taxidermic work and storage of boxes and supplies.

Mr. McGregor has had little time for collecting because of Journal work. A month's trip was made to Guam, for the purpose of instructing a botanical collector in the employment of the Guam Experiment Station, while some time was devoted to collecting insects and other specimens. By the coöperation of Mr. J. B. Thompson, special agent in charge of the Guam Station, the Bureau of Science is receiving, by each transport, 2 sets of Guam plants collected entirely by the man trained by Mr. McGregor. One of these sets is retained by the Bureau of Science and the other is named and returned to the Guam Station. The arrangement is proving very satisfactory to this Bureau.

In lieu of vacation leave, the collector went to Dupax, Nueva Vizcaya, in February and collected in the vicinity of that town during the months of March and April. Some 4,000 sheets of plants and small collections of insects, birds, and other specimens were secured.

The assistant collector, during the biological expedition to Port Galera, was detailed to work under the direction of Doctor Griffin. During the year he has done some paid work, such as mounting deer heads and large game fishes and tanning snake skins;

there is a probability that his time could be fully employed in this sort of work. The only other really good taxidermist in Manila died during the last year, and undoubtedly some of his regular customers would be glad to avail themselves of the services of our taxidermist.

A small outbuilding for handling large specimens of fishes and mammals is greatly needed.

THE CHEMICAL LABORATORY

The late director of this Bureau arranged that he, together with certain of the employees of the Bureau of Science, should undertake to give instruction in chemistry in the University of the Philippines. This gave to the students of the University the benefit of contact with minds not only well disciplined with pedagogical principles and theoretical sciences, but also imbued with the broad vision and spirit of activity characteristic of practical work. It was his hope that eventually young Filipinos might be properly trained in the science of chemistry to serve as assistants. We now have six Filipino chemists in this laboratory. During the last fiscal year, Dr. Paul C. Freer, Mr. Harry D. Gibbs, and Mr. José I. Del Rosario gave instruction in the University. On July 1 of this year, Mr. Harry D. Gibbs, chief of the division of organic chemistry and assistant to the director; Mr. Albert H. Wells and Mr. José I. Del Rosario, assistants in the division; and Mr. T. Dar Juan, an assistant in the division of general, inorganic, and physical chemistry, were detailed for part of their time, and Dr. A. P. West, an assistant in the latter division, was detailed to give all of his time to instruction in the University. Our own work is being sacrificed to a certain extent to carry on the work of the University. The readjustment of positions in the Bureau of Science has left some vacant chemists' positions which so far have been declined by men to whom they have been offered. The positions will be filled as soon as practicable, and the equilibrium of the laboratory restored.

THE LABORATORY OF GENERAL, INORGANIC, AND PHYSICAL CHEMISTRY

Alvin J. Cox, chief of this division, was detailed to duty in Baguio the latter part of April and returned in May to take up the duties of acting director of the Bureau. Mr. W. C. Reibling

Fig. 1. Sooty terns, *Sterna fuscata* (Linnaeus). Maeander Reef.

Fig. 2. Boobies on Usong Island, Tub-bataha Reef.

PLATE XIX. SOME PHILIPPINE SEA BIRDS.

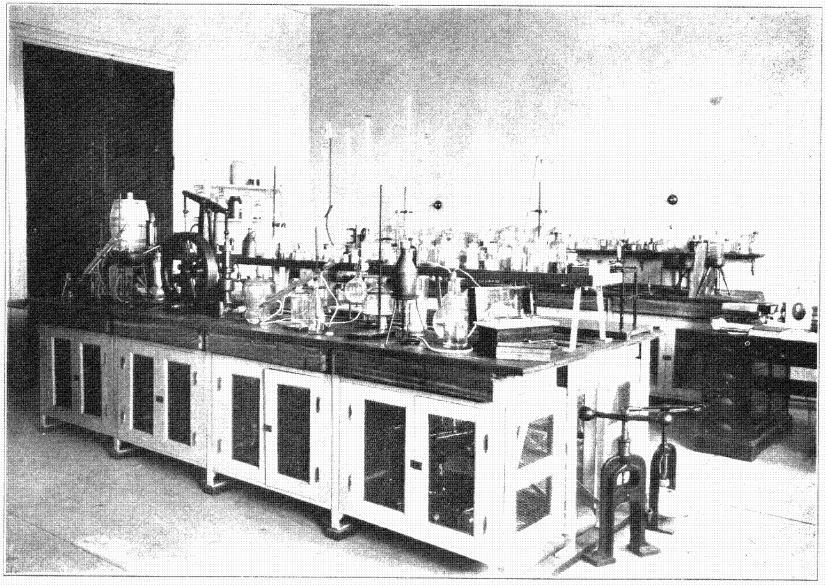

PLATE XX.—TYPE OF ROOM IN THE CHEMICAL LABORATORY.

was acting chief of this division during the last two months of the fiscal year. He was regularly appointed to the position on July 1. Mr. Reibling was absent on vacation leave until February 1, during which time he visited numerous scientific and industrial institutions in Europe and America, and devoted special attention to the testing and efficiency of structural and road materials and to the technology of cement, ceramics, and artificial stone industries.

Dr. A. P. West was detailed to Iloilo, where for three months he served in the capacity of acting chief of the Government Sugar Laboratory. He was absent two months on account of illness after his return. Mr. V. Q. Gana was also absent for over three months on vacation and sick leave.

ROUTINE WORK

The routine work of this division includes tests of heat insulations, burning and lubricating oils, and dust preventatives and binders, such as crude oil, tar, pitch, and asphalt; analyses of rocks, limestones, cements, cement raw materials, clays, waters, soils, fertilizers, coals, alloys, and inorganic commercial products; calorimetric determinations of fuels; standardizations of instruments of precision, of measure, and of chemical reagents and solutions; as well as physical tests of tile, pipe, cement, concrete, brick, mortar, aggregates, clay, road material, rope, wire, reinforcing iron, and steel; and service classifications of textile fabrics such as puttees, cloth, rain coats, and blankets.

The routine work done during the last fiscal year, together with that of 1911 and 1912, is shown by the following figures:

Nature of analysis or test.	1910	1911	1912
Rocks and minerals		25	46
Soils, fertilizers, cements, and clays	3,342	3,738	8,636
Metals and alloys	24	46	36
Road materials, stone, gravel, sand, and concrete		440	248
Water	82	164	146
Calorimeter determinations of fuels		29	9
Boiler tests of coal		10	2
Coal and analyses		154	20
Standardizations of weights and measures; sets		1,066	990
Miscellaneous[a]	248		248
Total	3,696	5,672	10,381

[a] Work classified under "Miscellaneous" in 1910 is largely segregated in 1911 and 1912.

The distribution of this work among the various bureaus and branches of the Government was as follows:

Bureau or branch.	Free work.	Cash work.	Total.
Bureau of Agriculture	15		15
Bureau of Audits	1		1
Bureau of Cónstabulary		7	7
Bureau of Customs	34	1	35
Bureau of Education	1		1
Executive Bureau		5	5
Bureau of Forestry	5	5	8
Bureau of Health	40		40
Bureau of Internal Revenue	3		3
Bureau of Justice		1	1
Bureau of Lands	12		12
Bureau of Navigation	10	30	40
Bureau of Posts	2		2
Bureau of Prisons		1	1
Bureau of Public Works	49	2,246	2,295
Bureau of Supply	456	6,224	6,680
Bureau of Science	93		93
Weather Bureau	4		4
City of Manila		179	179
College of Medicine and Surgery	2		2
Philippine General Hospital	6	2	8
Provinces and municipalities		657	657
United States Army and Navy		71	71
Total	733	9,429	10,160

These statistics represent only the routine work, but there has been a corresponding growth in other lines, and the increase in the number of routine analyses and tests is fairly representative of our usefulness. There is a constantly growing desire on the part of the general public to consult our scientists on theoretical and practical matters pertaining to mining, commercial, and industrial problems. Frequently we are able to reply to these requests simply by referring to reports or publications covering the point in question. At other times our increased familiarity with, and knowledge of, the country and its resources frequently enables us to give definite information where otherwise a lengthy and expensive examination would be necessary. The amount of correspondence resulting from requests for advice, information, and recommendations continues to increase.

We are especially in need of adequate machinery for testing materials of construction and of a building for installing the same. For the past five years this division has coöperated in testing and controlling the imported supplies purchased on a basis of specification. In each instance a remarkable increase in

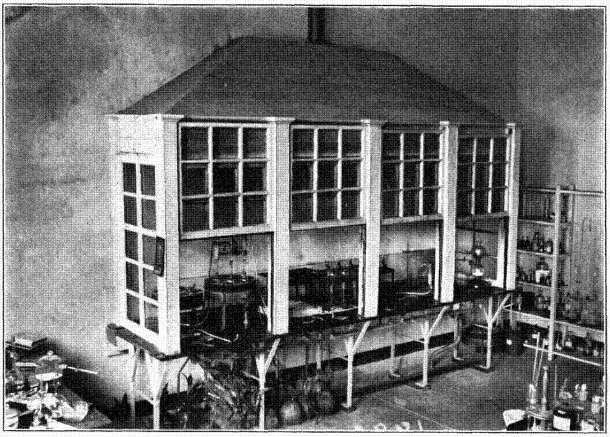

Fig. 1. One of the larger hoods in the chemical laboratory.

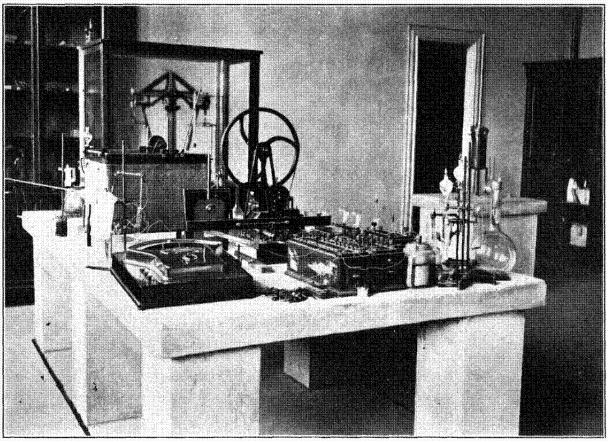

Fig. 2. Main room devoted to physical chemistry.

PLATE XXI.

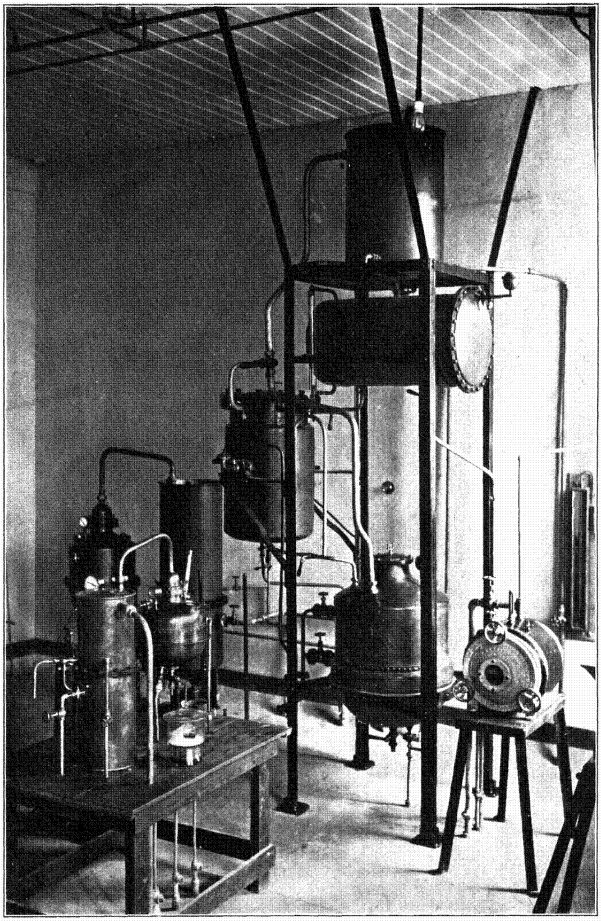

PLATE XXII. VACUUM DRYING AND DISTILLING APPARATUS.

Fig. 1. Coconuts, Mindanao.

Fig. 2. Manila hemp (abacá), Negros.

PLATE XXIII.

quality has been noted after their purchase under specification has been thoroughly instituted. Furthermore, this improvement in quality is usually secured without an increase in original cost. Experience throughout the world has demonstrated that the standardization of supplies and materials for construction saves time and money, and secures the best material and results. In the testing of materials and supplies, the Government of the Philippine Islands is far behind other progressive countries, and our force and equipment are less than those of large cities of Europe and America. There is urgent need of two additional employees in this division in order satisfactorily to keep up with the work.

INVESTIGATIONS

In spite of the readjustments in the laboratory, of men being on vacation leave, the absences on account of illness, and the large amount of routine work, a considerable amount of research work has been accomplished. A somewhat complete study of Philippine soils has been carried on. The chemical and physical properties of these and also some of the conditions which influence the soil; such as, rainfall, humidity, the maximum and minimum air temperature, the temperature under the surface, the amount of light and sunshine, winds and the evaporation of the soil moisture, exposure, and altitude have been taken into account. Any one of these may become a controlling factor in the production of a given crop. In the Philippines the rainfall is especially important for crops, such as coconuts, hemp, and tobacco, which are restricted to regions which have a rainfall well distributed throughout the year. The composition of the mineral constituents of the soil may indicate high fertility, but the physical nature may be such as to counteract this.

An investigation of the oxidation and deterioration of coal has been carried on. When oxygen is merely absorbed, it acts as a diluent, but, when it enters into composition or unites with the carbon or hydrogen of the coal, there is actual deterioration and often danger of spontaneous combustion. The avidity of coal for oxygen is very great. The danger from spontaneous combustion in storage piles may be reduced by assisting the escape of heat, preventing the access of air, and by protection from external sources of heat. Storage in the inert gases, nitrogen and carbon dioxide, prevents deterioration.

Parts IV and V of the Physical and Chemical Properties of Portland Cement have been completed, and are now in process

of publication. Part IV deals with the strength of Portland cement and Part V is a summary of the conclusions of Parts I, II, III, and IV. This publication is the result of five years' painstaking observations and careful experimental work on the part of the investigators. They have had exceptional opportunity to study the technology of manufacturing, testing, and use of Portland cement, and their work has given us a more reliable product in the Philippine Islands. It is realized that whatever the value of individual work, we must depend largely upon the efficiency of the standard specifications adopted by the American Society for Testing Materials and similar organizations for the improvement in quality of materials for construction. Our efforts will be directed toward the securing of the adoption of the best possible specifications.

A preliminary investigation of the possibility and economic feasibility of a local sand-lime-brick industry has been made. Sand-lime brick is not in any sense ordinary mortar brick, although both are made of the same cheap raw materials; namely, sand and lime. Sand-lime bricks are hardened by subjecting them to live steam pressure which causes a chemical combination to take place between the silica of the sand and the lime, and the resulting calcium hydrosilicate binds the copards together in a manner similar to vitrification. After steaming, the bricks are ready for immediate use and continue to harden with age. They absorb less moisture than any other brick except vitrified brick, and withstand heat to a remarkable degree. Samples have been heated to redness and then quenched with water without disintegrating. Local plants could produce a building stone which would meet all the demands of tropical climatic conditions for a structural material. A more comprehensive investigation has been planned, but this will have to be delayed till a better equipped, physical testing laboratory has been arranged. There is no question about the possibility of manufacturing sand-lime bricks from available raw material, but we are convinced that, in order to do so on a basis that will be successful and of great benefit to the country, careful consideration must be given to every detail of organization, technology, location, etc.

The successful solution of many of our local problems concerning material for construction must be solved by local research. The available information on many of these subjects is very meager, and only a few general results are applicable to the Philippines. A good illustration is the effect of local

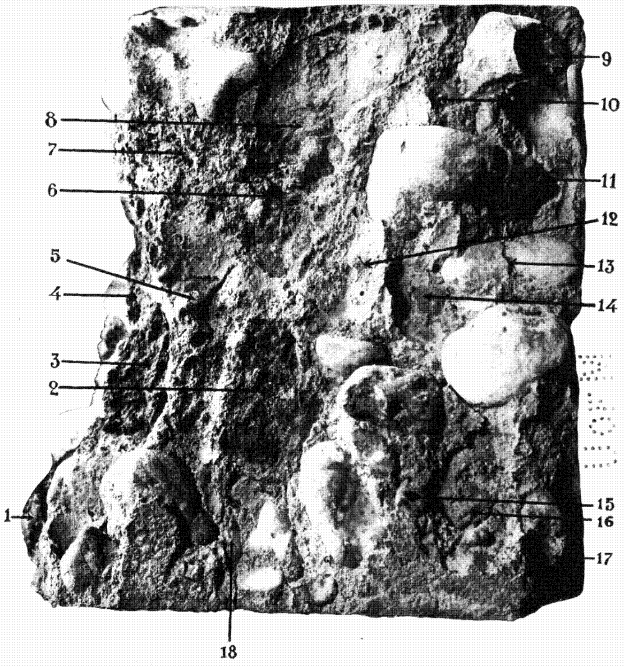

PLATE XXIV. CRUSHED CUBE OF CONCRETE, SHOWING DISINTEGRATION OF GRAVEL.

The low compressive strength of 1,011 pounds per square inch was due entirely to the use of poor gravel.

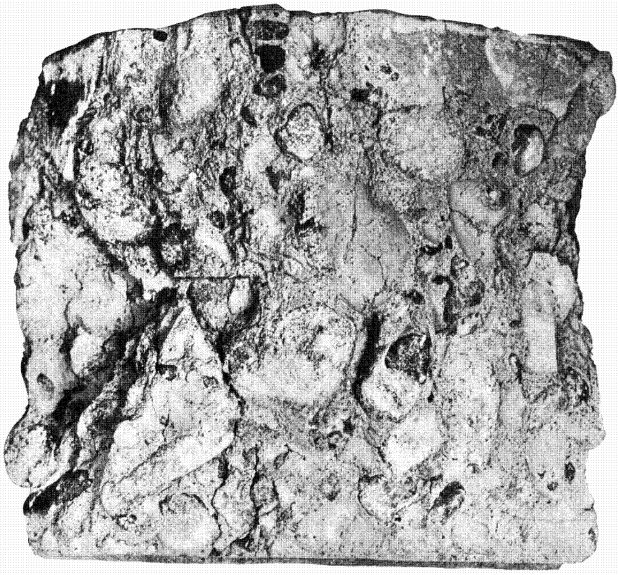

PLATE XXV. CRUSHED CUBE OF CONCRETE IN WHICH THE SAME BRAND OF CEMENT WAS USED WITH FIRST-CLASS AGGREGATE.

The 1:2.2:5 mixture withstood a compressive strength of 4,200 pounds per square inch.

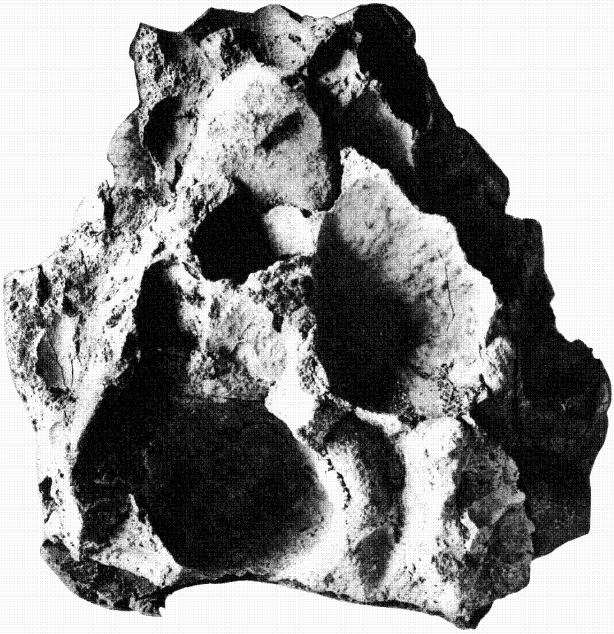

PLATE XXVI. CONE FROM CRUSHED CUBE OF CONCRETE FROM ABATAN RIVER, CORTES, BOHOL, SHOWING EFFECT OF USING GRAVEL COVERED WITH GREEN ALGÆ.

The compressive strength of 1:2:4 mixtures only averaged 668 pounds per square inch.

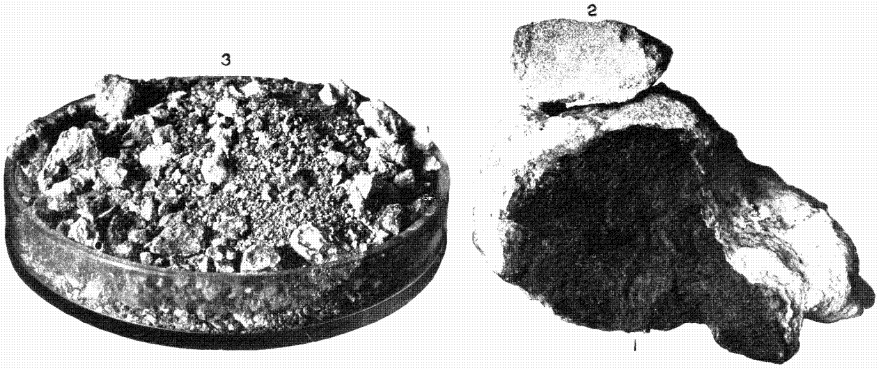

PLATE XXVII. PHOTOGRAPHS OF WELL-BURNED SOUND (NO. 1) AND UNDERBURNED DISINTEGRATED (NO. 3) COMMERCIAL PORTLAND CEMENT CLINKERS FROM THE SAME KILN AND MIXTURE.

The sound clinker had twice the efficiency of the underburned material, but a ground mixture of 45 per cent of the disintegrated and 55 per cent of the sound clinker passed Philippine cement specifications in all respects except in the percentage loss on ignition.

Fig. 1. Characteristic crystals obtained from slaked lime in Portland cement.

The presence of a small amount of slaked lime is not detrimental to the efficiency of Portland cement.

Fig. 2. Characteristic crystals obtained by the microscopic test from nonsintered lime in Portland cement.

Nonsintered lime must be present in quantity to cause unsoundness.

Fig. 3. Characteristic plume-like formations of crystals obtained from coarse particles of sintered lime in Portland cement.

On account of slow slaking properties, the presence of fused or sintered lime is very detrimental to the efficiency of Portland cement.

PLATE XXVIII.

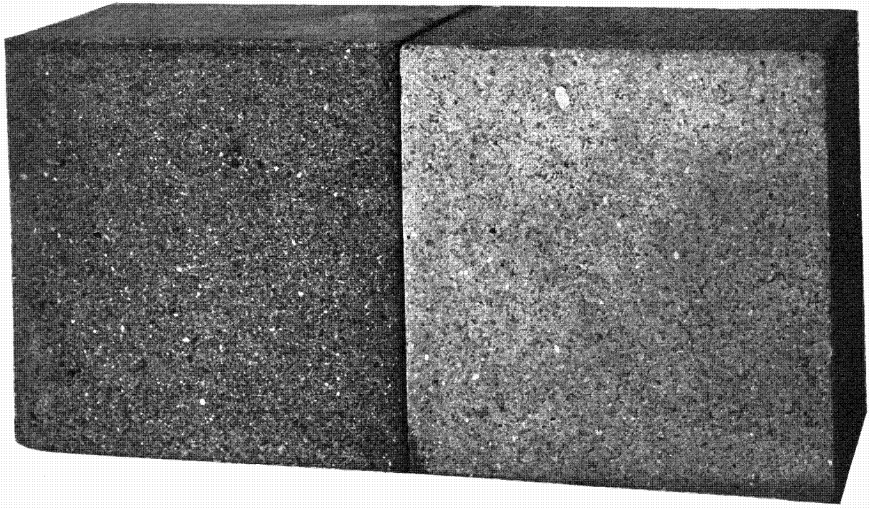

Fig. 1. Sand-lime brick made from Pasig sand.

A compressive strength of 5,935 pounds per square inch was readily obtained.

Fig. 2. Sand-lime brick made from Benguet sandstone.

This material gives a very pleasing cream-gray color and takes a good polish. It withstood a compression of 7,300 pounds per square inch.

PLATE XXIX.

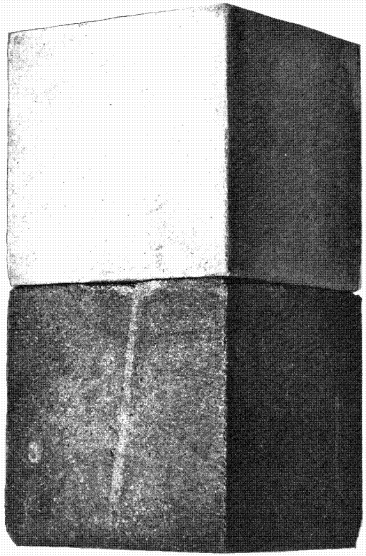

Fig. 1. Sand-lime brick made from Talim basalt quarry débris.

Beautiful, polished, strong, dense "artificial marbles" can be made from this material.

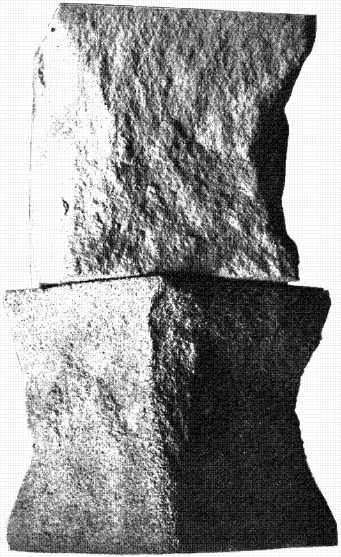

Fig. 2. Sand-lime brick made from Maytubig beach sand.

A compressive strength of 3,840 pounds per square inch was obtained without grinding any of the sand.

PLATE XXX.

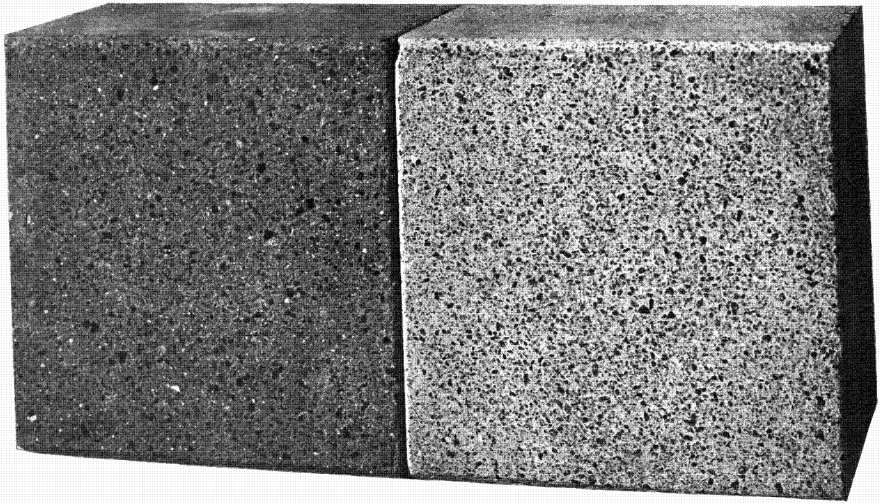

Fig. 1. Sand-lime brick made from Meycauayan volcanic tuff.

A strength above 5,000 pounds was readily obtained, but for best results the volcanic tuff should be mixed with hard-grained sand or crushed rock.

Fig 2. Sand-lime brick made from Sisiman andesite quarry débris.

Like the basalt débris, this is especially suited for the manufacture of ornamental stone work and artificial marbles.

PLATE XXXI.

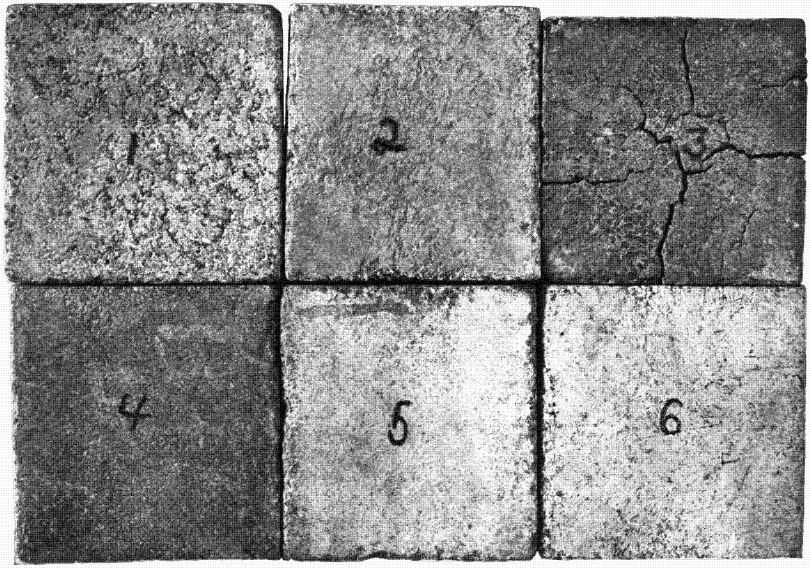

PLATE XXXII. SAND-LIME BRICK MADE FROM PHILIPPINE RAW MATERIALS. HEATED TO 1,100° C., AND PLUNGED INTO WATER.

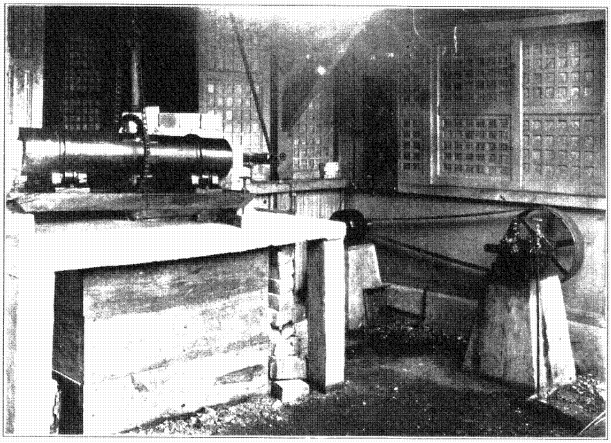

Fig. 1. Vertical and rotary cement kilns and air compressor manufactured in the Bureau of Science.

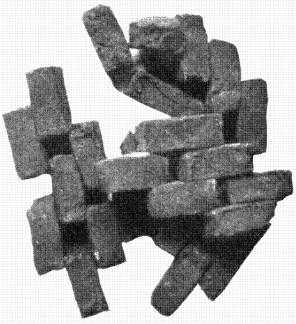

Fig. 2. Perfectly sintered Portland cement clinker made from available Philippine raw materials and burned in our experimental kiln.

Fig. 3. Perfectly sound Portland cement made from available Philippine raw materials.

PLATE XXXIII.

climatic conditions on the volume constancy of cement and sand mortars which is now being studied. In all probability the severely cracked condition of much of our local concrete work is due to alternate contraction and expansion, and undoubtedly the cause can be eliminated after the subject has been sufficiently studied. Protective coatings, paints, cement mortar, concrete, paving stones, tars, asphalts, pitches, dust preventatives, natural and artificial building stones, woods, paving blocks and bricks, iron and steel, etc., may give excellent service in some climates, but poor efficiency in the Tropics. There is a great deal of work to be done on each of these subjects. On the other hand, the enforcement of specifications formulated so as to include the effects of freezing might fail to secure the best results consistent with needs here. There is no standard method for the examination and classification of dust preventatives and bituminous binders satisfactory for work here, nor are there any very definite data on the various products under different conditions of service in these Islands. This laboratory, the Bureau of Public Works, and the City Engineer are working to adopt a standard method of testing and to ascertain the significance of the physical and chemical properties of various products and materials by a careful study of their efficiency in actual service. In time, results obtained in this way will be of great value.

The time of Messrs. F. B. Beyer and T. Dar Juan has been occupied with routine chemical work during the past year. They have proved to be exceptionally capable and versatile chemists, but have had little opportunity for research work. Mr. Beyer has begun a comprehensive study of the subject of the corrosion of metals and protective coatings. It is a difficult but important field of investigation, and I hope that he may be relieved more than heretofore of the routine work in order to have time for research.

The work on the manufacture of Portland cement from Philippine raw material has been continued. Many experimental difficulties have been overcome, and clinker burned so as to be free from fuel contamination has produced a good Portland cement. This work is now progressing rapidly.

A paper on the oxidation and deterioration of coal by Alvin J. Cox and one by W. C. Reibling, summarizing the work on the physical and chemical properties of Portland cement, will be read before the Eighth International Congress of Applied Chemistry to be held in Washington, D. C., during the year.

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with such mixtures, in both of which directions our work has been fairly successful.

The influence of various factors on the polarization of sugar has also been investigated. The whole of the apparatus used has been carefully calibrated and standardized, and every possible source of error separately dealt with, its possible and probable magnitude determined, and means taken to reduce such error to negligible proportions.

Mr. Boney of the Bureau of Education has been working, with the assistance of this division, on the bleaching of pandan fibers with the object of establishing the hat-making trade in the Philippines. Two substances—sabutan and raffia—made from the common seashore pandans, have been investigated. A method has been evolved which, though fairly successful, may be improved by further work.

The composition of carabao milk has been taken up recently, and is now under investigation. Samples are being obtained under personal supervision, complete analyses are being made, and it is hoped accurately to ascertain the variations and the average composition of this kind of milk.

The study of sunlight and sunlight reactions has been continued with encouraging results. The late director of this Bureau, Dr. Paul C. Freer, was able to carry on coöperative work with men in other parts of the world in temperate and semitropical, as well as in tropical, climates. If this work can be continued, it will no doubt throw much light upon the question of the residence of white men in the Tropics. A Hilger spectroscope has been added to the laboratory equipment for work on tropical sunlight. In this instrument, quartz lenses and prisms replace the glass and allow careful investigation of the ultraviolet range of the spectrum. This will permit further work on tropical sunlight along lines previously omitted for lack of apparatus. The work was summarized by Doctor Freer in a paper read before the Far Eastern Medical Association at Hongkong in December, which was later published in the Philippine Journal of Science, Section B, 1912, and by Doctor Freer and H. D. Gibbs in a paper to be read before the Eighth International Congress of Applied Chemistry to be held at Washington, D. C., during this year. Various phases of the work will be continued.

The constitution of various oximes is being studied by means of their absorption spectra, new compounds of this type are being made, and it is hoped that many points of interest concerning their constitution may be settled. The reason why some of these substances yield colored and others colorless salts will also

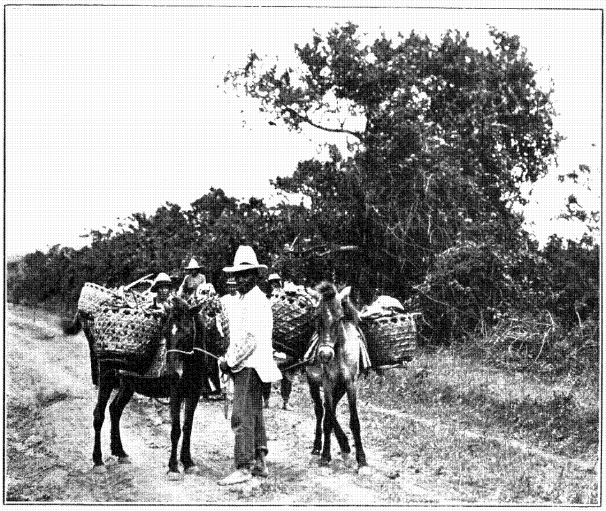

Fig. 1. Transporting oranges.

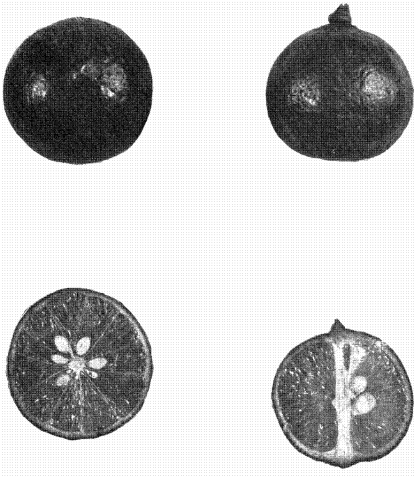

Fig. 2. Dayap.

PLATE XXXIV.

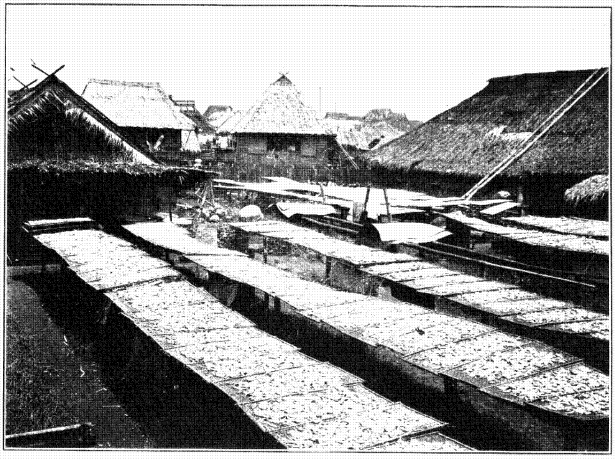

Fig. 1. Fish drying in the sun.

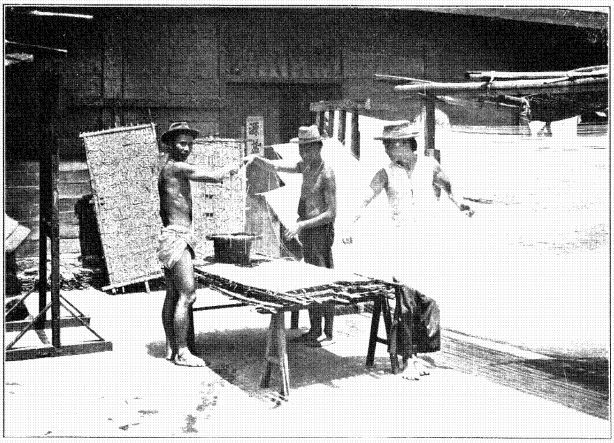

Fig. 2. Misua and miqui drying on frames.

PLATE XXXV.

PLATE XXXVI. INTERIOR OF A CHOCOLATE FACTORY, MANILA.

be studied when it can be done without interfering with other work.

The investigation of native food products is being continued, and two articles will soon be ready for publication.

The work of the Iloilo Sugar Laboratory is discussed on page 53.

DIVISION OF MINES

Dr. W. D. Smith, chief of this division, has been absent on leave since February 20, with instructions to investigate the latest methods in coal, iron, and oil mining and treatment. This information will be obtained principally in Washington, Pittsburg, Chicago, and the oil fields of California. Mr. R. A. Rowley of the University of the Philippines was made a special employee of this Bureau. Mr. Feliciano Nable was made a temporary employee on November 1, 1911, but resigned after working five months.

ROUTINE WORK

During the year 216 assays for private parties, 20 free assays for prospectors in new districts and on official requests, and 327 assays on black-sand research, besides 18 bullion assays and 141 placer weighings were made. By crediting the free assays and allowing for the amalgamation, cyanide, screen, and concentration tests performed on black sand, the total work performed amounts to ₱2,846. Tests have been completed on ores from several localities in the Philippines, and one was made on ore sent from China. This work is especially important, as such tests are not made elsewhere in the Orient. The investigations of ores and ore deposits have already proved of importance to the mining industry. The assay laboratory has also been of great service to the prospector. The development of the geology of the Philippine Islands has progressed slowly, owing to the great demand for the services of the geologists to investigate and report on geological or engineering problems of strictly economic value. A large number of these investigations have been made for private parties, but many were undertaken in order to discover the economic possibilities of various deposits and thereby aid in advancing the mining industry.

Reports made for private parties are of two classes: (1) a report which is absolutely confidential and for which ₱50 per day for the services of the chief of party, and all expenses for the party, are charged; (2) a report which is available for publication after six months. The latter is made only where information of value to the Government can be obtained. For

this class of report ₱8 per day for the chief of party and all expenses of the party are charged. During the year 3 first-class and 1 second-class reports have been made. The time spent upon these examinations, which consisted of reports on 8 mining properties in Baguio, Benguet; on the Eastern mine, Aroroy, Masbate; on the available raw material for the manufacture of cement in the Philippines; and on the rock quarries of Talim Island, Laguna de Bay, amounted to two hundred ten and one-half days, divided among 4 members of the division.

Geological reconnaissance work was carried on in Pangasinan, Tayabas, and Palawan. The sections which have been covered by general geological surveys are: Batanes, Benguet, Pangasinan, Zambales, Tarlac, Pampanga, Bataan, Bulacan, Rizal, Cavite, Batangas, Laguna, Bondoc Peninsula, Ambos Camarines, Albay, Sorsogon, Panay, Cebu, and Leyte. Partial surveys have been made in Ilocos Norte, Ilocos Sur, Lepanto, La Union, Tayabas, Negros, and Mindanao. Detailed mapping has been completed in the Baguio mineral district, Aroroy mineral district, Cebu mineral district, and Batan Island.

INVESTIGATIONS

The following research for publication in the Philippine Journal of Science has been completed during the past year:

Black sands of Paracale.—It is shown that the values thrown away in the black-sand concentrates, or lost on account of the large quantities of black sand present, were almost equal to the values recovered by the dredge. A large percentage of these values can be economically saved. The magnetite and ilmenite, which caused the concentrates to look black, contain practically no value. The high value is due to quartz grains carrying metallic gold and to gold-bearing iron pyrites. Important results were obtained from screen tests, amalgamation tests, concentration tests, and magnetic separation tests. This investigation should prove of great value to the dredge operators of the district.

Ore deposits of the Philippines.—The ore deposits of the Philippines were formed during Tertiary or post-Tertiary age. They occur filling fissures in andesite, diorite, and granite gneiss. Some subordinate veins are found as contact deposits between igneous and sedimentary rocks. The gold veins in general vary in width from 2 to 5 meters and in a large number of cases can be traced on the surface for a kilometer or more. The most important so far exploited are quartz manganese veins which usually contain large quantities of calcite as well. The next in importance are the quartz veins carrying tellurides of gold.

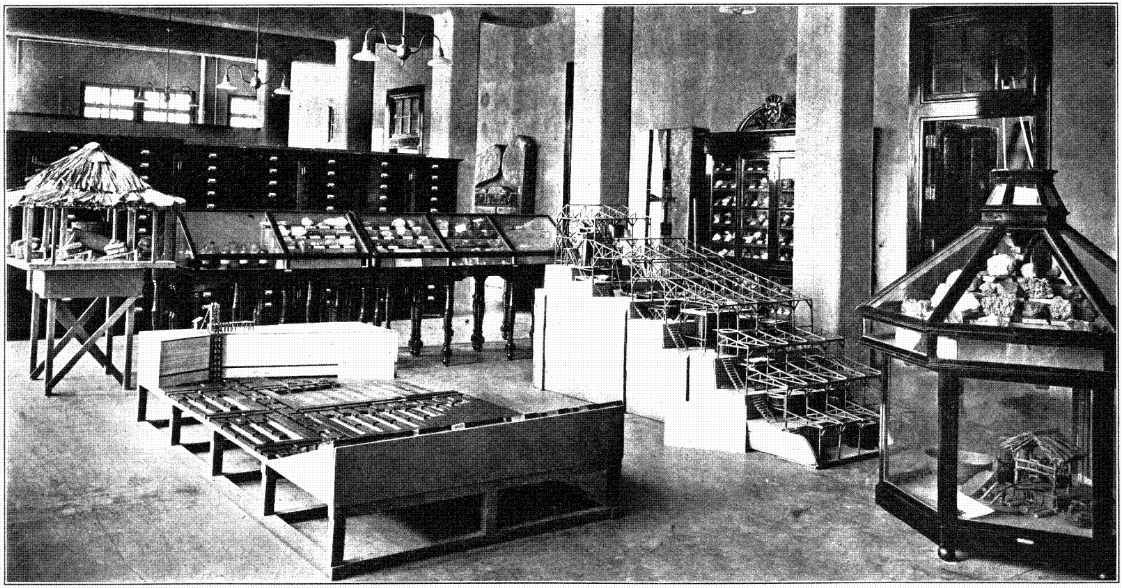

PLATE XXXVII. EXHIBIT ROOM, DIVISION OF MINES.

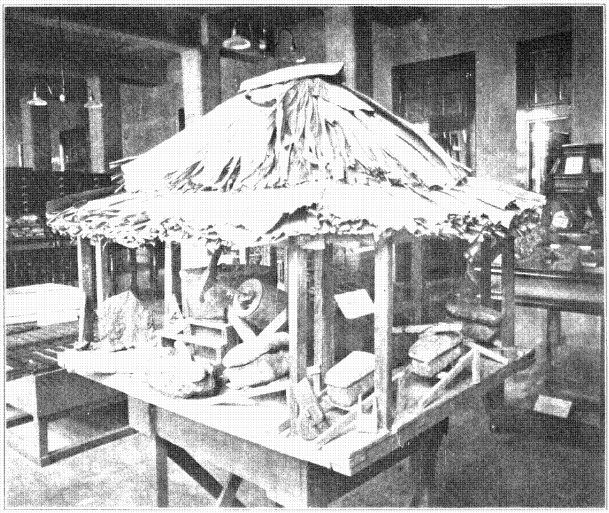

Fig. 1. Model of Filtoino iron smelter.

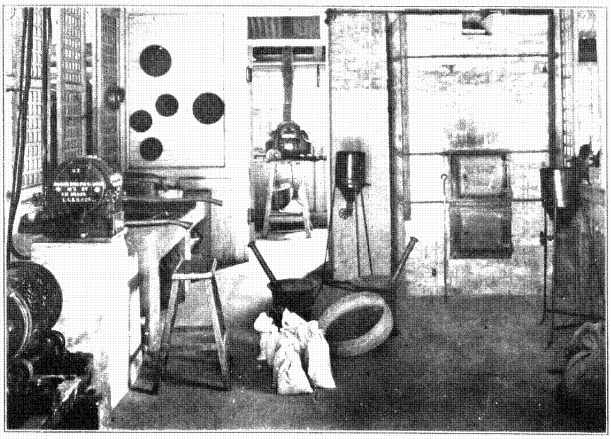

Fig. 2. Assay house.

PLATE XXXVIII.

One deposit of this class has been prospected in Baguio and another in Suyoc. The development has been almost wholly in the zone of oxidation and enrichment in the veins carrying manganese, consequently no data are obtainable as to primary ore.

Placer-gold deposits are numerous and cover large areas. They are the natural result of the erosion of a country filled with gold-bearing veins and stringers.

Bulacan iron deposits.—A survey with dial compass and dip needle was made to determine, if possible, the extent of these iron deposits. The use of the dial compass and dip needle was only partially successful, due to the irregularity of the deposits and the presence of boulders of iron on the surface, but the geological study of the country showed that there were several deposits of iron and ore which were sufficiently large to warrant exploitation.

Raw materials for cement.—Several localities have been found where material suitable for the manufacture of cement can be mined. Samples from numerous deposits of limestone and shale were collected and analyzed. Very favorable deposits were found in Cebu. The limestone and shale showed percentages of silica, iron, alumina, and lime, which should make a high-grade Portland cement. The rocks are soft and would present but little difficulty in crushing. A good deposit of coal is nearby that can be mined to supply fuel. Transportation conditions are good, and the product can be laid down at a sea port at a small cost.

Geological reconnaissance of Pangasinan.—In 1911, northwestern Pangasinan came into a little prominence through the persistent reports of copper and other metallic deposits. Oil also was reported by prospectors to exist in quantity. A geologic reconnaissance confirmed the occurrence of copper, gold, silver, iron, manganese, and antimony, but the deposits apparently are of no value. No evidence of oil or coal was seen.

Igneous rocks were found in the eastern and southern portions of the area, but these are older than the sedimentaries which occupy the greater part of the region. The sedimentaries are of Tertiary age, and the absence of metamorphism is a characteristic feature. Analyses of specimens of the sedimentaries showed excellent cement-making constituents, and the large size of the deposit would warrant complete investigation.

A brief account of the mineral resources of most of these districts, including the mineral districts of Cansuran, Aroroy, Masbate, and others, are contained in the Mineral Resources of the Philippine Islands for the Year 1911.

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Cansuran mineral district.—The placer deposits of the Cansuran district, located about 15 kilometers south of Surigao, Mindanao, near the center of the Surigao Peninsula, were among the first to attract attention in the Philippines. The gold occurs as placer in a gravel deposit from 5 to 10 meters deep, which covers the crests and sides of the hills and which has an estimated value of more than 50 centavos per cubic meter. This should be a paying mining property. The valleys are filled with wash from 15 to 25 meters deep, which also may prove to be valuable as placer. The gold is the coarsest yet found in the Philippines. Nuggets weighing over 15 grams are frequently discovered, and some weighing 30 to 40 grams can be found among the heirlooms of the native families of Surigao.

Most of the placers covering the hills can be worked by means of a hydraulic machine. Water power can be obtained at a small cost from the Tugunaan River, which has a large volume of water flowing all the year round.

Other districts.—The Aroroy district has become the most prominent mining district of the Philippines due to the success of the Colorado mine and mill. Another promising property in this district is the Eastern mine. A great deal of development work has been done, and a large body of good ore has been blocked out.

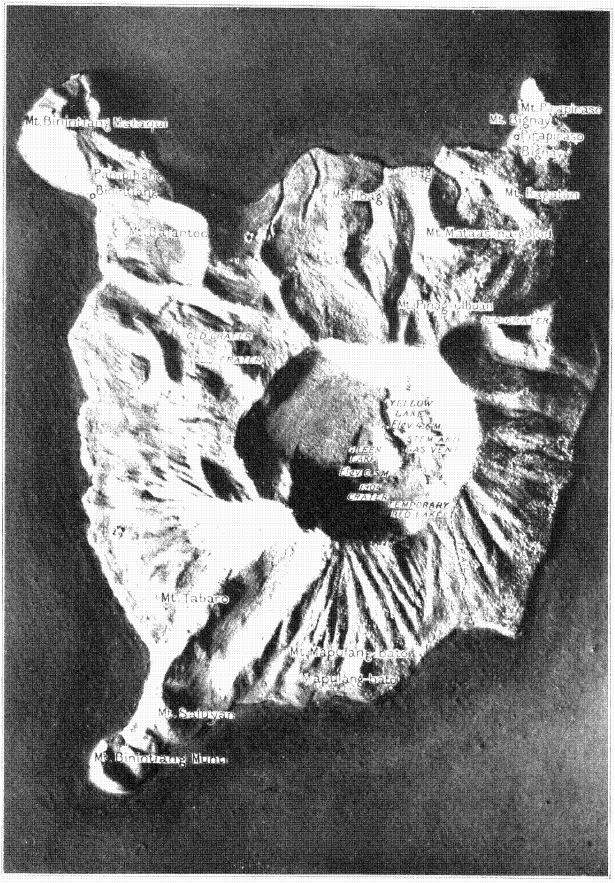
The Paracale district has become prominent on account of its placer deposits. Three large dredges are being built and will be operating within a year.

The Baguio district has experienced the troubles and failures of all new mining districts where inexperience and lack of sufficient capital have resulted disastrously. Only two mines are at present operating, but the value of other properties has been demonstrated.

Ore deposits have been found in the Lubang district of Benguet, in Zambales, Batangas, Marinduque, Mindoro, Cebu, and Leyte, which some day may prove of economic importance.

Other work with regard to the chemical action in a calcite manganese, quartz, gold-bearing vein, the Philippine ores and their method of treatment, and vitrified brick is in progress.

The need for suitable legislation in regard to mining has been suggested by the complaints of operators and prospectors and the occurrence of circumstances not covered by law. We shall be pleased to coöperate in drafting more suitable and comprehensive legislation.



XXXIX. MODEL OF TAAL VOLCANO.

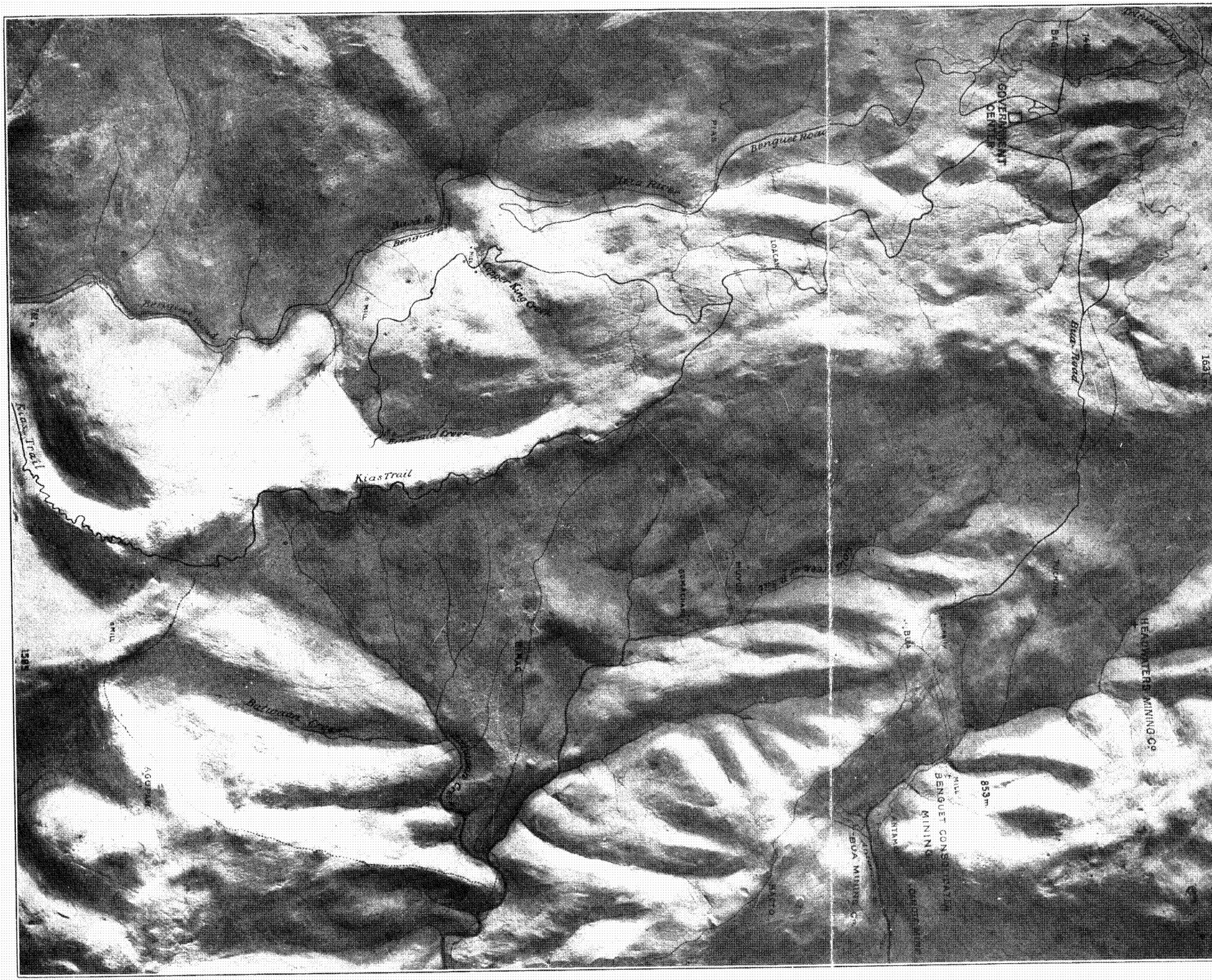


PLATE XL. MODEL OF BAGUIO, BENGUET.

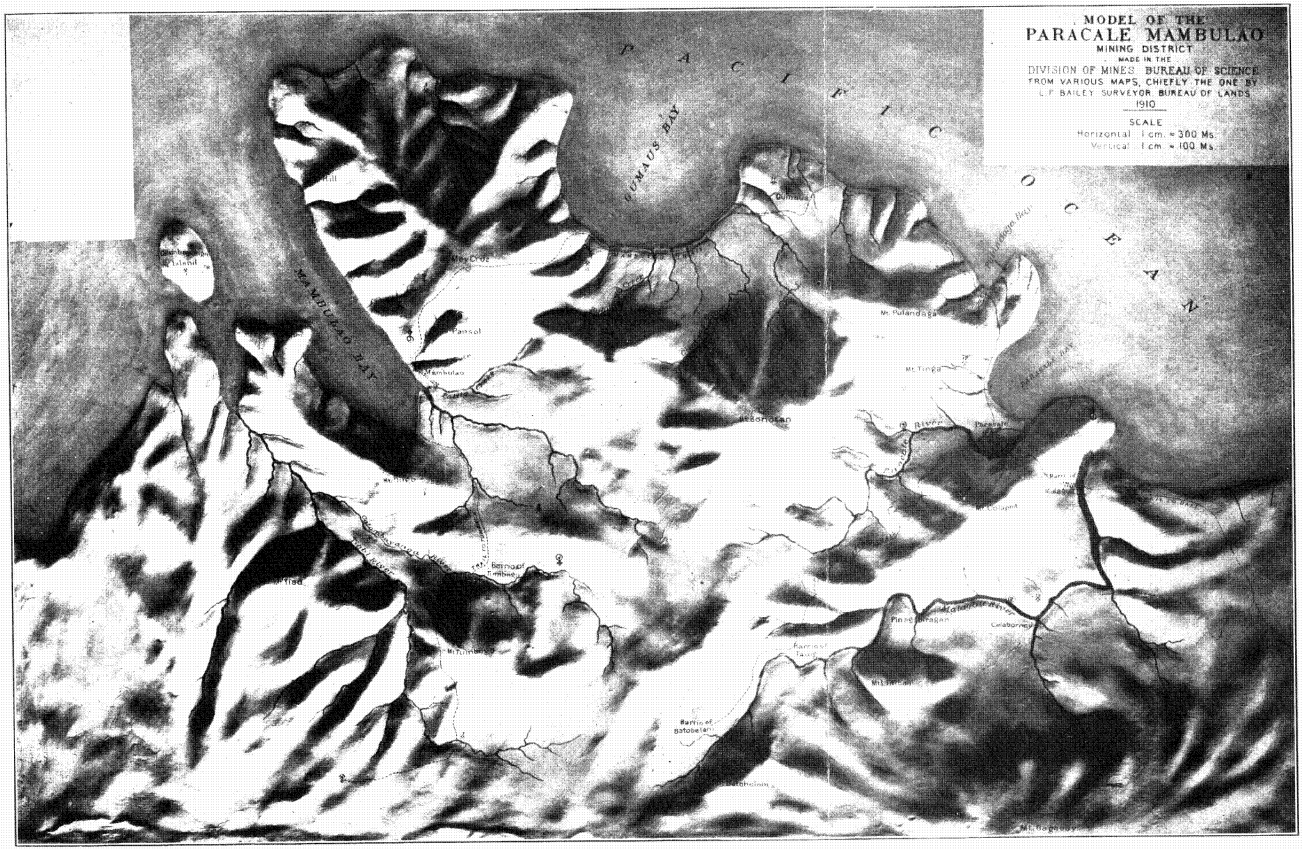


PLATE XLI. RELIEF MAP OF PARACALE-MAMBULAO MINING DISTRICT, AMBOS CAMARINES.

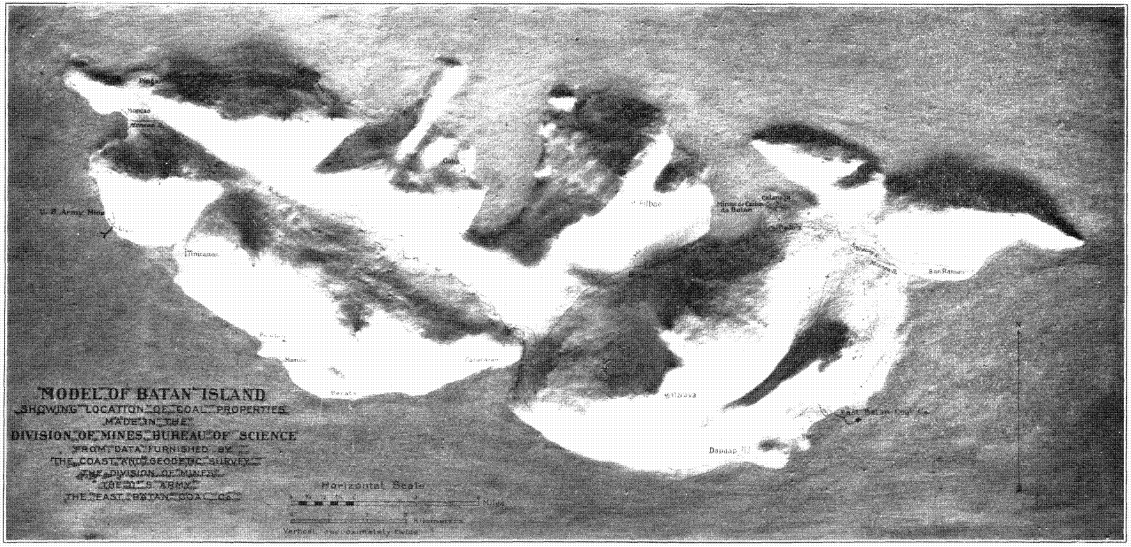


PLATE XLII. RELIEF MAP OF BATAN ISLAND.

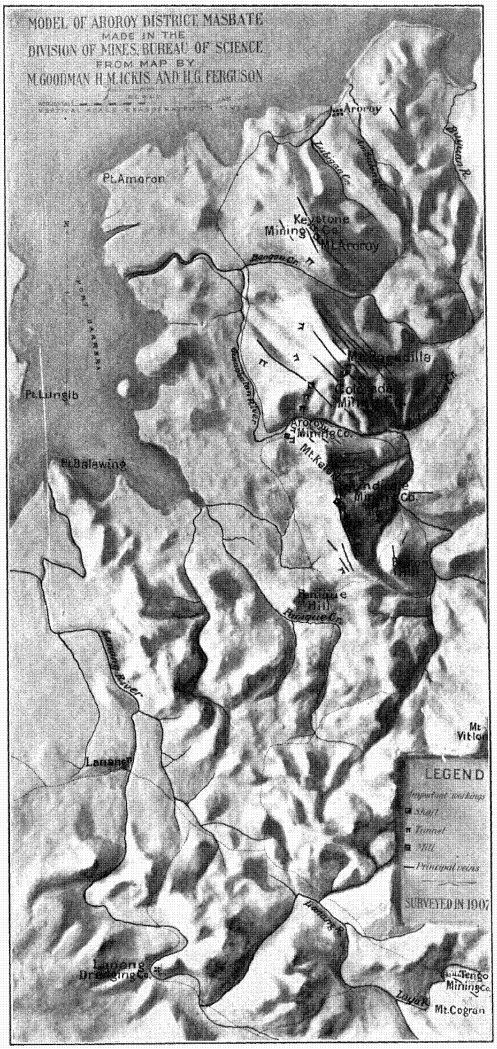


PLATE XLIII. RELIEF MAP OF AROROY MINING DISTRICT, MASBATE.

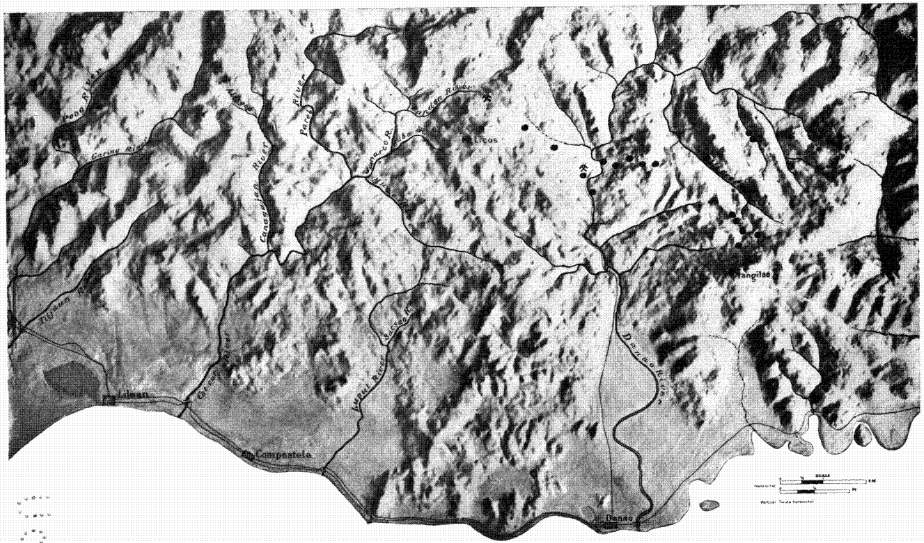


PLATE XLIV. RELIEF MAP OF COMPOSTELA-DANAO.

DIVISION OF ETHNOLOGY

There has been no change in the personnel of this division during the year. On November 2 a disastrous fire occurred in the vicinity; many of our exhibits were moved into the street, and the museum was badly disorganized. Some specimens were lost, and cases were damaged. The entire force was busy for a time putting the museum in order. Within two months the collections were again arranged, and improvement has since steadily continued. Metal tags have been put on a large number of specimens. In spite of the unfavorable location of the museum, there is a constantly increasing number of visitors.

The study of the Iloco people, begun last year, has been continued up to the present time with a few interruptions, and is still in progress. The vicinity of Vigan was especially studied, and most of the towns in the Province of Ilocos Sur were visited. The collections made from this region consist mainly of stone objects from San Esteban, hats, fish nets, and an extensive collection of cloths woven by the Iloco people.

Two short articles have been written for the Philippine Journal of Science as a result of this work, one on the stone industry of San Esteban and the other on the wood-working industry of San Vicente. The greater part of the collected information is reserved for publication in a general paper on the Iloco people.

Work on the general ethnology of the Ifugao people is also being continued.

Mr. Garvan, a temporary employee of the division, was in Mindanao until the middle of December. Since that time, in spite of ill health, he has nearly completed his paper on the Manobos of the Agusan Valley, Mindanao.

Doctor Miller spent the months of March, April, and May in Mindoro continuing his investigations among the Mangyans, and Mr. H. O. Beyer is preparing the results of his work among the Ifugaos for publication.

We have recently received 10 new museum cases, 5 of the upright and 5 of the flat top ones. They will be devoted to the collection from the Iloco provinces. In order to accommodate further additional cases when they become necessary, we will have to crowd the present cases together or provide a storeroom outside so that the space now occupied by the storeroom can be used for exhibition space. It is very desirable that provision be made for a general Philippine museum in which the increasing collections can be installed and where they will be safe from fire.

The accessions made during the year are numbers 4938–5044, 5051–5169, 5171, 5173–5445, distributed as follows:

Mangyan (4938–4950)	13
Montesco. Negros (4951–4953)	3
Fish traps. Gift of A. Seale (4954–4980)	27
Rubber. Purchased from A. W. Prautch (5001–5036)	36
Rubber. Gift (5037–5040)	4
Sponges. (4986–5000, 5041–5043, 5112–5117)	24
Skulls. Bohol. Gift of R. C. McGregor (4884–4885)	2
From various sources: (4981–4983, 5044). (5051–5111, 5118–5169, 5171, 5173–5238)	202
Iloco. Collected by E. B. Christie (5258–5445)	188
Total	499

LIBRARY

Miss Mary Polk, librarian, returned to the library from leave on October 24, 1911. Miss Huldah E. Kupfer was transferred from the library to work on the Philippine Journal of Science in December, 1911.

The work of cancellation of old memorandum receipts for books issued to other bureaus of the Department of the Interior has been very slow, but is now practically complete. Such volumes as were desired were reissued under the present charging system which has proved adequate and satisfactory. Many of the miscellaneous publications and reprints which accumulate rapidly have been classified. An inventory of the maps and charts was made and their filing revised. Nothing more can be done on these until we have an additional map cabinet. One was included in the list of furniture to be purchased for the new wing, but was not ordered by the Bureau of Public Works on account of lack of funds. They have also been asked to include this in finishing the building.

The collection of catalogues of universities and colleges was revised, many additions were received, and numerous requests were sent to such institutions as had failed to forward their more recent issues. This collection is now fairly up to date and is frequently consulted.

Library of Congress printed cards to the number of 2,537 have been received, and the filing of these has increased materially the value of our reference catalogue. All bound volumes in the library were examined before they were moved for evidence of attacks of insects, and 1,725 volumes were fumigated. More than 175 packages of proofs of Library of Congress cards, each averaging 700 slips, have been cut and filed. We also have some

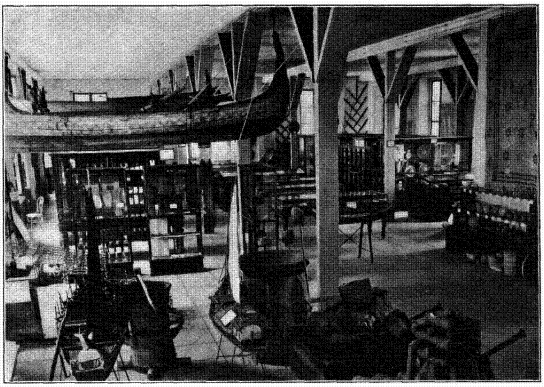


Fig. 1. Museum, showing one end of the first floor.

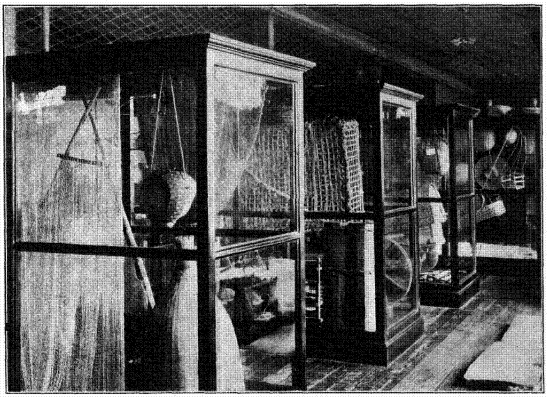


Fig. 2. Iloco cases.

PLATE XLV.

PLATE XLVI. DATO BADAO AND WIFE.

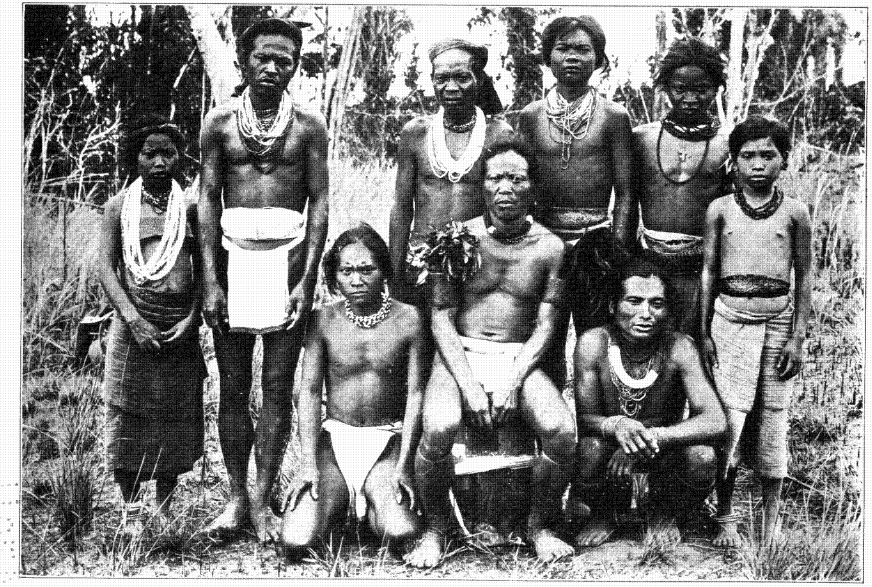


PLATE XLVII. MANGYAN MEN AND GIRLS, NEAR BULALAKAO.

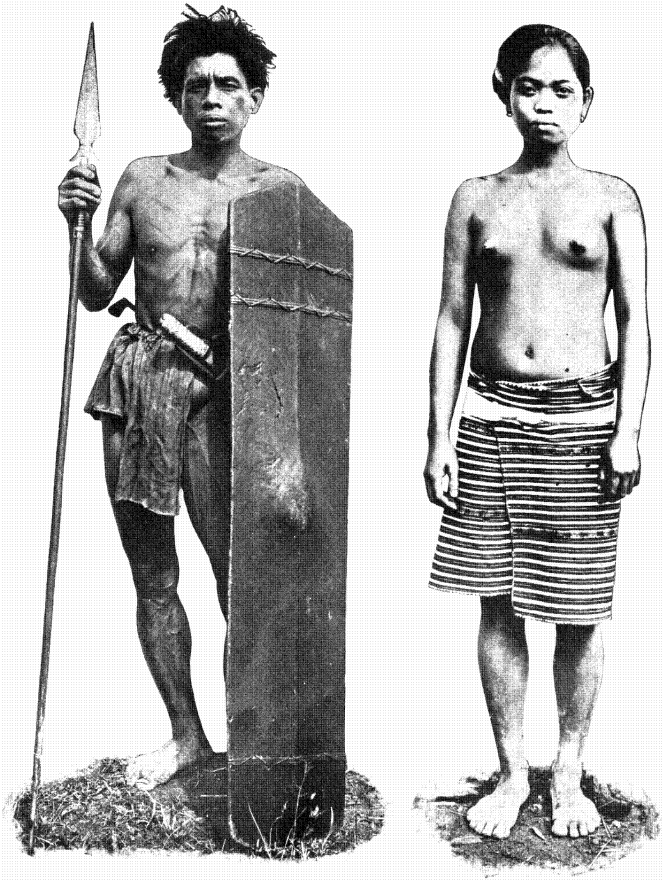


PLATE XLVIII. IFUGAOS OF QUIANGAN.

cards issued by the American Library Association and some from the John Crerar Library. We have begun a union catalogue of these cards, and it already has proved valuable.

Requisitions for books and new subscriptions to periodicals to the amount of ₱8,311.31 have been sent out. This amount appears unusually large until it is considered that a great proportion of the books were ordered for the Unversity of the Philippines and some for the Bureau of Health, to be paid for by them, though prepared for circulation in the library of the Bureau of Science.

In March the library was moved into the new wing where the available shelf space is sufficient to accommodate the normal growth of three or four years. This entailed a large amount of work in general arrangement, and in labeling shelves, stacks, etc.

Accessions.—The number of bound volumes accessioned during the past year was 2,225; 1,179 by binding, and 1,046 from all other sources. Under the new arrangement by which books desired by the University of the Philippines and by some of the other bureaus are entered on our records and stand on our shelves, our statistics will assume larger proportions.

Some of the notable accessions during the year follow:

Journal der Pharmacie für Aerzte, Apotheker und Chemisten, 66 vols. 1794–1834.
Cuvier. Le règne animal, 20 vols. 1828.
Pharmaceutische Zeitung, 26 vols. 1883–1908.
Journal of physiology, 44 vols. 1878–1909.
Graefe-Saemisch. Handbuch d. gesamten Augenheilkunde, 11 vols.
Abderhalden—
Biochemisches Handlexicon, 6 vols.
Handbuch der biochemischen Arbeitsmethoden, 6 vols.
Real-Enzyklopedie d. gesamten Pharmazie, 12 vols.
Roxburgh. Flora indica, 2 vols. 1820.
Archiv für die gesamte Physiologie, 116 vols. 1868–1907.
Rheede. Hortus indicus malabaricus, 8 vols. 1678–88.
Agassiz. Contributions to the natural history of the United States of America, 4 vols.
The Auk, 19 vols. 1884–1901.
Annals of surgery, 16 vols. 1885–1890.
Medical record, 58 vols. 1886–1900.

Classification and cataloguing.—The figures for this work are as follows:

Nature of work.	Bound volumes.	Unbound volumes.	Parts.	Shelflist cards.	Catalogue cards.
Classified	2,529	4,192	3,022	1,083	2,474
Reclassified	186	23	26	22	58

The subject work has been begun, and the usefulness of the catalogue is already perceptibly increased. Reclassification frequently is necessary, due to the fact that the final schemes issued by the Library of Congress differ considerably from the original typewritten schemes first used.

Binding.—This year we sent 1,400 volumes to the Bureau of Printing to be bound, 1,061 volumes were returned, 510 of which were sent out before July 1, 1911. This leaves 849 still undelivered. During the next fiscal year it will be necessary to bind 2,000 volumes if we send out all new volumes as soon as they are completed.

Use of the library.—The charging system installed last year has enabled us to keep an accurate check on our circulation. The issues per month have averaged 701, a daily average of 23. The number of volumes in circulation at the end of the month averaged 3,497. The total number of issues was 8,420. These figures show a considerable increase over last year. There is no time limit on the circulation of the greater number of our publications. Were there the ordinary limit of two weeks or even one month, these figures would be increased several times. The above numbers do not include the readers from this and other bureaus of the Government, and many persons not in the Government service who frequently consult our valuable reference library. The exact number of persons using the library is not known.

We are able to use Filipino helpers more than heretofore. We now have five boys who are working part time and who promise to become thoroughly efficient. It is hoped that some time will be found to give special instruction to these workers and to direct them in a course of reading along lines of library work and interests and so to develop them that eventually they may occupy responsible positions in the library.

ENGINEERING DIVISION

There have been no changes in the direct supervision of the power plant or the responsible employees during the year, Mr. José Guerrero y Reyes remaining as chief engineer and Mr. F. Y. Ycasiano as assistant engineer.

Many changes have been made in order to provide for the new power units being installed by the Bureau of Public Works. The two tanks, heated by exhaust steam for the purpose of furnishing hot water to the Philippine General Hospital, which were originally installed in the boiler room, have been moved outside to the west of the building in order to make room for the instal-

PLATE XLIX. LIBRARY, SHOWING A CORNER OF THE READING ROOM AND A PORTION OF THE STACKS.

lation of the new boiler unit. Some excavating was done for the base of these tanks, and lugs were put on one-third of the distance from the bottom for carrying the weight of the tanks so that they would not extend so high in the air and be liable to overthrow by earthquakes. The installation of the new boiler unit is nearly completed. The original plan was to erect a separate shed to hold the new producer-gas plant unit, but instead the main building of the power plant has been extended to contain this.

The 67-horsepower Otto producer-gas plant, ordered from the Gasmotoren Fabrik Deutz, arrived several months ago and is now being installed. The subsoil in this vicinity is nearly pure sand and, in order to get a satisfactory foundation to carry the 15-ton engine, it was deemed necessary first to drive piles on which the cement slab base for foundation was placed. When the producer-gas plant is installed and operated, it will furnish sufficient light and power for the Philippine General Hospital, the Bureau of Science, and the College of Medicine and Surgery. As soon as both the producer-power unit and the new boiler are ready for use, the engineering force will have a much-needed opportunity to clean, overhaul, and repair the engine and boilers. It will be necessary to renew the brick work of the present boiler furnaces, and it is hoped we can arrange to separate the two boilers so that we can repair one without stopping the other. As it is now, it is necessary to put both of these units out of commission in order to make repairs on either.

The addition of the new boiler interferes very seriously with the ventilation in the engine room and, furthermore, the continuous operation of the plant greatly increases the temperature. Our dynamos at certain times have to run with overload. Dynamos stand overloading very much better when there is good ventilation, and I believe that this can best be improved by large ventilating holes in the roof.

Some of the insulation on the steam pipe leading to the central power plant has not yet been properly put on, and there is unavoidable loss of heat.

Machine shop.—Two hundred fourteen jobs, the value of which is estimated at ₱4,000, were completed in the carpentry and machine shop during the fiscal year. Most of this work was done for the Bureau of Science. That for other branches of the Government consisted in the manufacture and correction of standard measures, repair of surgical instruments, beds and sterilizers, nickel plating, etc. Our engineering force also installed the new library stacks in the new wing and removed the shelves from the old library and erected them in other rooms.

Engineering room.—During the fiscal year, the total electric current generated was 179,192 kilowatt hours. The cost of production was ₱18,419,86, or ₱0.10279 per kilowatt hour, a cost much below that of any single month of the first half of the calendar year 1911. Of the total current generated, 59.03 per cent was consumed in the Philippine General Hospital, 6.84 in the College of Medicine and Surgery, and the remaining 34.13 in the Bureau of Science.

Boiler room.—The total weight of steam generated in the boiler room was 9,944,858 kilograms. The cost of production was ₱25,691.75. Of the total, 41.32 per cent was used in the Philippine General Hospital, 0.906 in the College of Medicine and Surgery, 8.25 in the Bureau of Science, 5.46 in pumping the tunnel, and the remaining 44.062 was consumed by the steam engines to generate electrical power.

An attempt has been made by the Bureau of Public Works to waterproof the tunnel connecting the central power plant with the Philippine General Hospital and the College of Medicine and Surgery by excavating the tunnel and putting a thin slab of treated rich cement mortar on the top and sides. We have not yet had sufficient rain to test the efficacy of the method.

The producer-gas plant is guaranteed to operate successfully on Philippine coal. It is several times as efficient to convert coal into producer gas for use in a gas engine for the production of electric power as to burn the coal under boilers for the production of steam with which to operate dynamos. If this producer-gas plant is a success, it should materially reduce the cost of the production of our power and greatly assist in the introduction of cheaper power for manufacturing purposes in the Philippine Islands. As soon as the plant is installed and ready to operate, a series of careful tests will be carried on.

THE PHILIPPINE JOURNAL OF SCIENCE AND OTHER PUBLICATIONS

No change has been made in the sections of the Philippine Journal of Science except that with the first number of Volume VII the designation of Section B, Medical Sciences, was changed to Section B, The Philippine Journal of Tropical Medicine. With Volume VII, a better grade of text paper is being used. This, taken with a new machine type face recently installed by the Bureau of Printing, makes a marked improvement in the appearance of the Journal.

The following is a list of the articles printed in the Philippine Journal of Science for the fiscal year. Members of the staff of the Bureau of Science are marked by an asterisk (*).

PLATE L. REAR VIEW, SHOWING POWER PLANT.

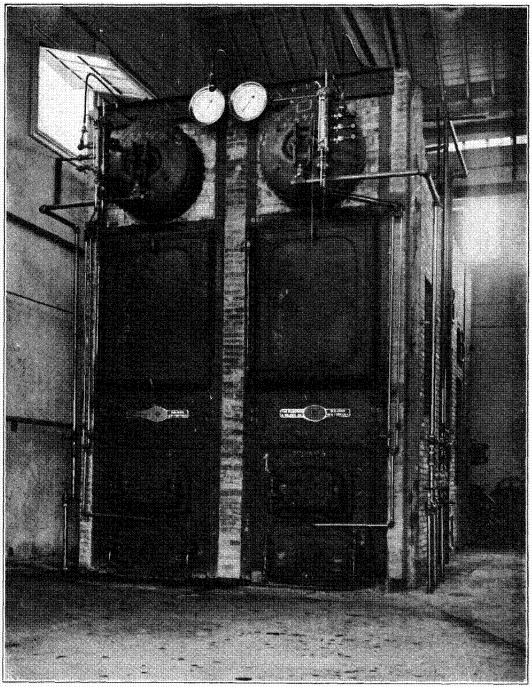


PLATE LI. TWO OF THE BABCOCK AND WILCOX BOILERS.

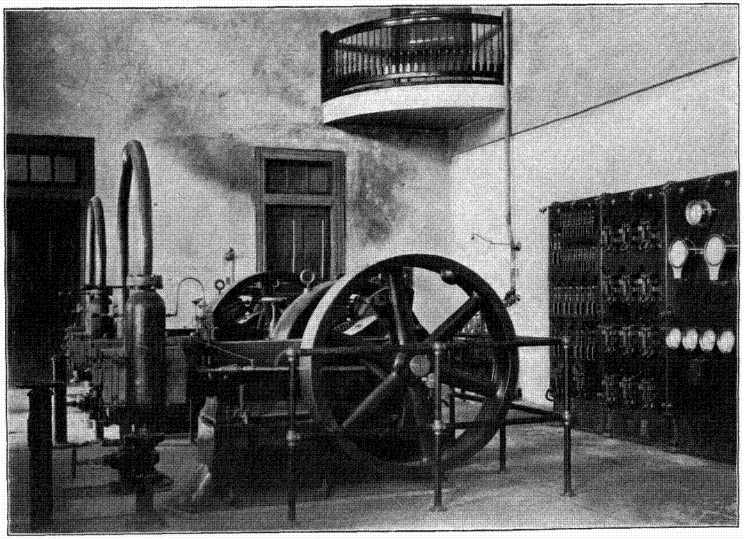


PLATE LII. A CORNER OF THE ENGINE ROOM.

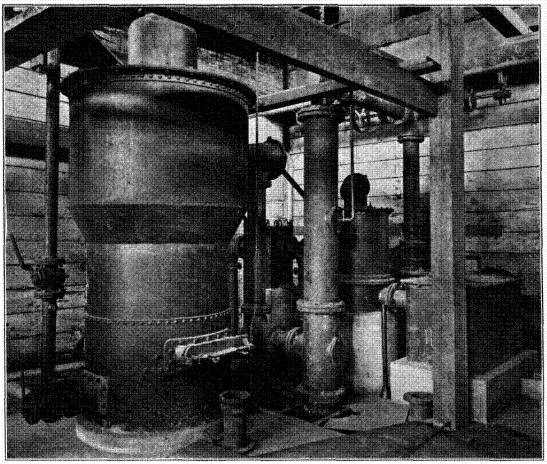


Fig. 1. Producer-gas plant.

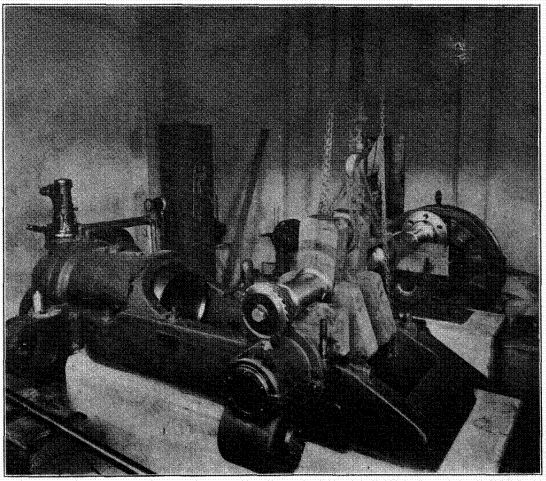


Fig. 2. Producer-gas engine.

PLATE LIII.

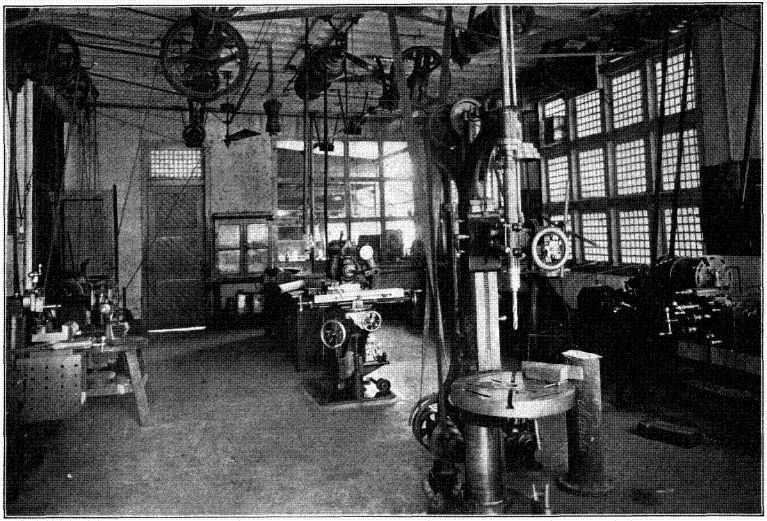


PLATE LIV. MACHINE SHOP, SHOWING SHAPER, UNIVERSAL MILLING MACHINE, PRESS DRILL, LATHE, ETC.

SECTION A. CHEMICAL AND GEOLOGICAL SCIENCES AND THE INDUSTRIES

* Adams, George I., and * Pratt, Wallace E. Geologic reconnaissance of southeastern Luzon.

* Brooks, Benjamin T. New Philippine essential oils.

———. Editorial: The fluctuation in the value of ylang-ylang oil and some of its causes.

* Cox, Alvin J. Chemical and physical characteristics of Philippine coal.

———. Philippine Guano.

———. Philippine soils and some of the factors which influence them.

* Ferguson, Henry G. The geology and mineral resources of the Aroroy District, Masbate.

* Gibbs, H. D. The action of sunlight upon methyl alcohol.

———. The interference of hydrogen peroxide with the milk tests for formaldehyde.

———, and * Agcaoili, F. Soja-bean curd, an important oriental food product.

——— ———. The alcohol industry of the Philippine Islands. Part III. Fermented beverages which are not distilled.

———, and * Holmes, W. C. The alcohol industry of the Philippine Islands. Part II. Distilled liquors; their consumption and manufacture.

———, *Williams, R. R., and * Pratt, D. S. Methyl salicylate III. The coloration of methyl salicylate and some allied compounds in the sunlight.

Herrmann, Raf. A theory on the formation of the Central Luzon Plain.

* Pratt, D. S. Roselle.

* Reibling, W. C., and * Reyes, F. D. Physical and chemical properties of Portland cement. Parts IV and V.

* Smith, Warren D. Geological reconnaissance of Mindanao and Sulu: III. General and economic geology.

———, and * Eddingfield, Frank T. Additional notes on the economic geology of the Baguio mineral district.

SECTION B. MEDICAL SCIENCES, VOLUME VI, NOS. 4, 5, AND 6; SECTION B. THE PHILIPPINE JOURNAL OF TROPICAL MEDICINE, VOLUME VII, NOS. 1, 2, AND 3

Andrews, Vernon L. Infantile beriberi.

Aron, Hans, and Hocson, Felix. Rice as food: Investigation of the nitrogen and phosphorus metabolism on a diet consisting principally of rice and other vegetable foods-stuffs.

* Barber, M. A. Studies on pneumonic plague and plague immunization. X. Immunization of guinea pigs by vaccination with avirulent plague bacilli mixed with agar.

———. Studies on pneumonic plague and plague immunization. XI. The infection of guinea pigs, monkeys, and rats with doses of plague bacilli ranging from one bacillus upwards.

———, and * Teague, Oscar. Studies on pneumonic plague and plague immunization. XII. Some experiments to determine the efficacy of various masks for protection against pneumonic plague.

Bloombergh, Horace D. The Wassermann reaction in syphilis, leprosy, and yaws.

Chamberlain, Weston P. A study of the systolic blood-pressure and the pulse rate of healthy adult males in the Philippines. Based on 6,847 blood-pressure readings on 1,489 individuals, and an equal number of pulse counts on the same persons.

———. Observations on the influence of the Philippine climate on white men of the blond and of the brunette type.

———. The occurrence in the Philippines of associated spirochætæ and fusiform bacilli in ulcers of the throat (Vincent's angina), of the mouth and of the skin, and in lesions of the lungs (bronchial spirochætosis).

———. The red blood corpuscles and the hæmoglobin of healthy adult American males residing in the Philippines. Based on 1,418 red cell counts and 1,433 hæmoglobin estimations performed on 702 soldiers.

———. Typhoid fever in the Philippine Islands.

———, and Vedder, Edward B. A second contribution to the etiology of beriberi.

——— ———. A study of Arneth's nuclear classification of the neutrophiles in healthy adult males and the influence thereon of race, complexion, and tropical residence.

——— ———. The effect of ultra-violet rays on amœbæ, and the use of these radiations in the sterilization of water.

——— ———. The so-called X-bodies as artefacts in glass slides.

——— ———, and * Williams, Robert R. A third contribution to the etiology of beriberi.

* Crowell, B. C. Addison's disease and adrenal tuberculosis.

Mucocele and diverticulum of the vermiform appendix of inflammatory origin.

Fox, Carroll. Some common Siphonaptera of the Philippine Islands.

* Freer, Paul C. The result of the past two years' work in the study of tropical sunlight.

* Gibbs, H. D. A study of the effect of tropical sunlight upon men, monkeys, and rabbits, and a discussion of the proper clothing for the tropical climate.

Heiser, Victor G. Typhoid fever in the Philippine Islands from the sanitary standpoint.

* Sellards, Andrew Watson. Immunity reactions with amœbæ.

* Strong, Richard P. Studies on pneumonic plague and plague immunization. I. Introduction. The expedition to Manchuria and the conditions under which the work was performed there.

———, and Teague, Oscar. Studies on pneumonic plague and plague immunization. II. The method of transmission of the infection in pneumonic plague and manner of spread of the disease during the epidemic.

——— ———. Studies on pneumonic plague and plague immunization. IV. Portal of entry of infection and method of development of the lesions in pneumonic and primary septicæmic plague. Experimental pathology.

——— ———. Studies on pneumonic plague and plague immunization. V. Clinical observations.

——— ———. Studies on pneumonic plague and plague immunization. VI. Bacteriology.

* Strong, Richard P., and * Teague, Oscar. Studies on pneumonic plague and plague immunization. VIII. Susceptibility of animals to pneumonic plague.

——— ———. Studies on pneumonic plague and plague immunization. IX. Protective inoculation against pneumonic plague.

———, * Crowell, B. C., and * Teague, Oscar. Studies on pneumonic plague and plague immunization. VII. Pathology.

* Teague, Oscar, and * Barber, M. A. Studies on pneumonic plague and plague immunization. III. Influence of atmospheric temperature upon the spread of pneumonic plague.

* Walker, Ernest Linwood. A comparative study of the amœbæ in the Manila water supply, in the intestinal tract of healthy persons, and in amœbic dysentery.

———. The schizogony of Trypanosoma evansi in the spleen of the vertebrate host.

SECTION C. BOTANY

Ames, Oakes. Notes on Philippine orchids with descriptions of new species, IV.

———. Notes on Philippine orchids with descriptions of new species, V: The genus Bulbophyllum in the Philippine Islands.

Beccari, O. The palms of the Island of Polillo.

Brand, A. Additional Philippine Symplocaceae, II.

* Brown W. H. The mechanism of curvature in the pulvini of Mimosa pudica.

Copeland, Edwin Bingham. Cyatheae species novae orientales.

———. New or interesting Philippine ferns, VI.

———. New Papuan ferns.

———. New Sarawak ferns.

———. The genus Thayeria.

———. The origin and relationship of Taenitis.

Dunn, S. T. Philippine Mellittias.

* Foxworthy, F. W. Philippine Dipterocarpaceae.

Gamble, J. Sykes. A new species of Schizostachyum.

Groves, H. and J. Characeae from the Philippine Islands.

* Merrill, E. D. Notes on the flora of Manila with special reference to the introduced element.

———. Sertulum Bontocense: New or interesting plants collected in Bontoc Subprovince, Luzon, by Father Morice Vanoverbergh.

———. The Philippine species of Begonia.

Radlkofer, L. Simarubacearum genus novum philippinense.

* Robinson, C. B. Alabastra Philippinensia, III.

———. Philippine Urticaceae, II.

———. Urticaceae from the Sarawak Museum.

Wester, P. J. A contribution to the nomenclature of the cultivated anonas.

SECTION D. GENERAL BIOLOGY, ETHNOLOGY AND ANTHROPOLOGY

Beddard, Frank E. The Oligochæta terricolæ of the Philippines: Part I. The genus Pheretima.

* Beyer, H. Otley, and Barton, Roy Franklin. An Ifugao burial ceremony.

Felsche, Carl. Zwei neue Lucaniden der Philippinen.

* Griffin, Lawrence Edmonds. A check-list and key of Philippine snakes.

———. The anatomy of Aclesia freeri new species.

———. The structure of the pallial tentacles of Lima species.

Heller, K. M. Eine neue Gattung der Discolomidæ (Coleoptera) aus der orientalischen Region.
Hollister, N. A list of the mammals of the Philippine Islands, exclusive of the Cetacea.
* McGregor, Richard C. Record of a Puffinus new to Philippine waters and description of a new species of Micranous.
* Miller, Merton L. The non-Christian people of Ambos Camarines.
———. The Mangyans of Mindoro.
Moser, J. Beitrag zur Coleopteren Fauna der Philippinen.
Pearse, A. S. A new Philippine fiddler-crab.
———. Concerning the development of frog tadpoles in sea water.
———. On the habits of Thalassina anomala (Herbst).
———. The habits of fiddler-crabs.
Schneider, E. E. Notes on the Mangyan language.
* Seale, Alvin. The fishery resources of the Philippine Islands. Part IV. Miscellaneous marine products.
Shufeldt, R. W. The skeleton in the flying lemurs, Galeopteridæ.
Wagner, Hans. Ein neues Apion von den Philippinen.
Worcester, Dean C. Hybridism among boobies.
———. Newly discovered breeding places of Philippine sea birds.

Correspondence with regard to exchanges and reviews continues to absorb a large amount of time, and there is little prospect that there will be a decrease in this phase of the work.

The work of the Journal office has been hampered because the position of stenographer has been occupied by a number of persons, none of whom had any idea of proof-reading, and, never having been in the Bureau before, knew nothing of the preparation of copy for the Journal. The transfer of Miss Kupfer, who formerly had charge of the Journal for nearly a year, from the library to this work greatly facilitates the proper preparation of copy.

A Manual of Philippine Silk Culture was issued early in the year, and some assistance was rendered in the work of editing the copy for the Report of the International Plague Conference. The printing of A Flora of Manila by E. D. Merrill was begun toward the end of the fiscal year. Since the flora of Manila is similar to that of all the coast regions, the work will be of wider interest than the title indicates. This publication will be one of the largest and most important undertaken by the Bureau of Science.

The Bureau now employs 2 artists, but the one is so fully occupied with the work of making drawings of zoölogical and pathological specimens and the other so busy with the work of the division of mines that the work of the preparation of copy for plates and text figures to illustrate the Journal is at times seriously handicapped. The delay in finishing the colored maps

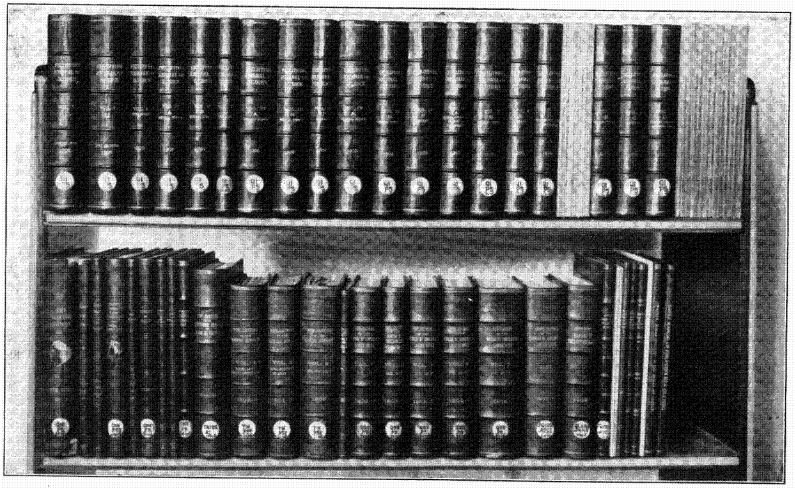


PLATE LV. PUBLICATIONS OF THE BUREAU OF SCIENCE.

for Nos. 5 and 6, Section A, Vol. VI, of the Journal was largely due to the fact that the man working on them was frequently interrupted to do other work. We are very much in need of another draftsman who could be kept busy making drawings of new species of plants for the section of botany when not preparing the necessary illustrations for the Journal.

The first numbers of the current volume of the Journal were greatly delayed, partly because the new paper was not definitely decided upon soon enough, but it is hoped that this defect will be remedied before the close of the volume. It is hoped that delays in issuing the numbers may be overcome, because the promptness with which a periodical publication is issued is considered to be an index of its vitality.

The mailing list of the Journal now comprises 855 names as against 722 at the end of the last fiscal year. Three hundred forty-one of these are *paid* subscriptions, 400 are exchanges, 68 are for review, and 46 are free copies. The increase in *paid* subscriptions during the year has been *sixty-five,* an increase of between 20 and 25 per cent. This increase is directly due to advertising. During the year about 3,000 personal circular letters have been mailed from many of which results will still be obtained. Some 4,000 of our general publication catalogues have also been mailed to various parts of the world. A considerable number of results can be traced directly to these printed catalogues.

On July 1 the outstanding accounts for the Journal and other publications amounted to ₱2,286.51. Of this amount agents owe ₱1,552.55, and individual customers with whom we deal directly owe ₱733.96. Active steps are always being taken to keep the amount of these outstanding accounts as low as possible. Agents' accounts cannot be pressed inasmuch as they ordinarily settle but once a year and we have experienced no difficulty in securing a settlement at least that often.

The total receipts from the Journal for this fiscal year have been approximately ₱3,025. The estimated cost of printing the Journal and the reprints therefrom for free distribution to contributors is estimated at ₱17,918. Wrapping paper, twine, etc., cost approximately ₱250. It is estimated that the time of those employees working on the Journal, either a part or all of the time, amounted to approximately ₱10,000 for the fiscal year. Thus the total cost of getting out the Journal for the fiscal year 1912, exclusive of postage, would be approximately ₱28,168. This estimated cost for the previous fiscal year was ₱24,605.70. Part of this increase is due to the appointment of an assistant to the editor, a part of whose salary must, of

course, be charged to the Journal. A small part of the increase is due to larger printing bills.

The value of the general publications of the Bureau of Science sold during the fiscal year was ₱1,723.52 as against ₱2,303.67 for the previous fiscal year. The decrease here is due to the fact that but one new publication has been added to the list during the year, and that our best selling publication, the Bontoc Igorot, was exhausted early during the year.

CLERICAL DIVISION

Mr. C. J. Stancliff was appointed property clerk the first part of the year; he has been absent on leave since February. Mr. G. P. Oakley was appointed stenographer and assistant to the chief clerk. Two temporary employees, Miss Huldah Kupfer and Mrs. Mamie E. Brown, qualified in the civil service and have been given regular appointments. The Filipino bookkeeper who does practically all of the accounting for the Bureau has been satisfactory. During the fiscal year 1911, the director approved the appointment of a Filipino stenographer in the office of the chief clerk as an additional step toward the Filipinization of the clerical force. After the failure of several male candidates it was decided to try a girl. She has done very well from the beginning, and can now handle routine dictation in English as accurately and as promptly as the average American stenographer. By exercising proper care in the selection of candidates, it is possible that Filipina stenographers can be secured to do certain work just as efficiently as it is done by American stenographers.

Filing.—Work on our files has continued throughout the year, and the records are now fairly accessible. The indexing of the files has been begun under the supervision of Mr. Oakley who is familiar with the system of cross indexing now so widely used. When this has been completed, it is believed that our files will be as readily and as easily accessible as would be possible under any system.

The use of bicycles introduced a year ago for special messengers has proved satisfactory.

The grounds of the new wing have made a slight increase in the amount of work required of the gardeners since the beginning of the fiscal year. The boys of the Bureau employed for general purposes have not much time to aid the lawn boys, although they do render some help. When the present building going on in the rear of the present grounds is finished, there will be some additional bits of lawn and roadway to care for.

PLATE LVI. CLERICAL ROOM.

Fig. 1. Carabao delivery cart in streets of Manila.

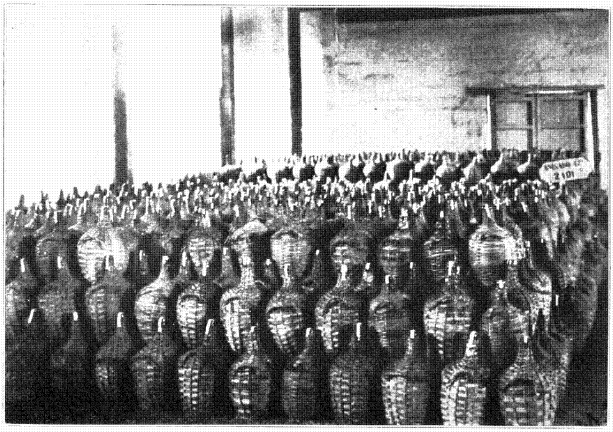


Fig. 2. Demijohns containing 38,416 liters of anisado made from nipa alcohol, ready for shipment.

PLATE LVIII.

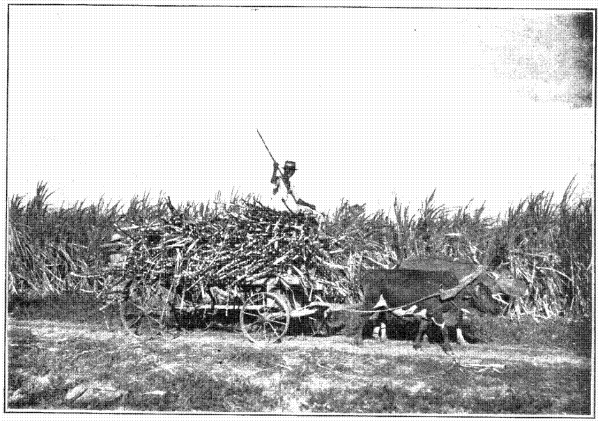


Fig. 1. Hauling cane from the field.

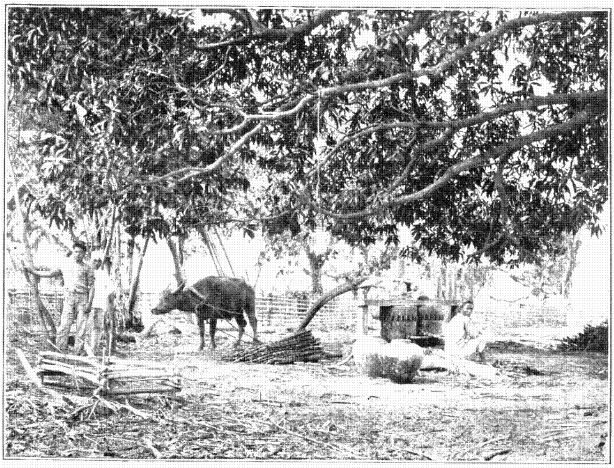


Fig. 2. Cane crusher near Agoo, Union Province.

PLATE LIX.

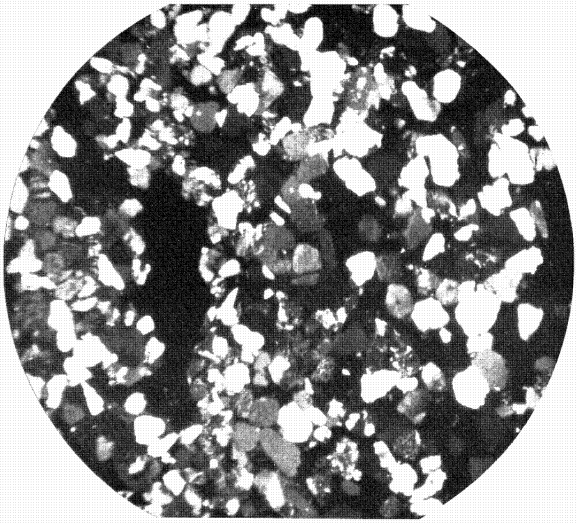


Fig. 1. Sandstone—a poor road metal.

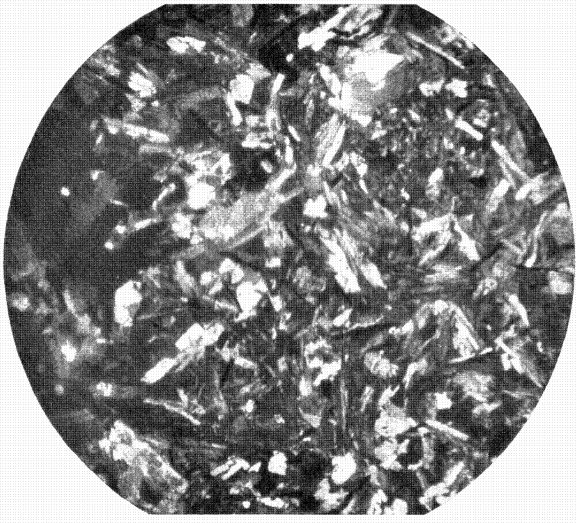


Fig. 2. Holocrystalline igneous rock—the texture makes this a good road metal.

PLATE LX.

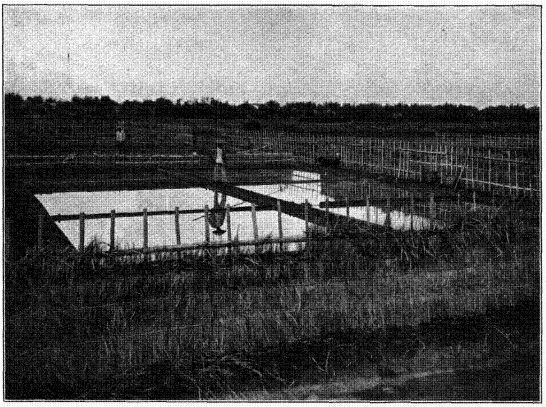


Fig. 1. The Chinese method of salt-making at Obando.

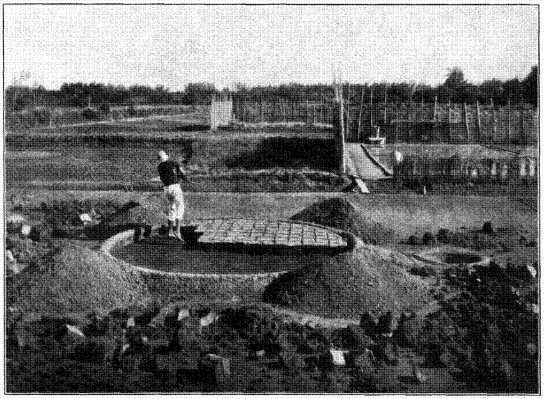


Fig. 2. One step in the rotation of a leeching vat.

PLATE LXI.

Fig. 1. Headwaters mill near Baguio, Benguet.

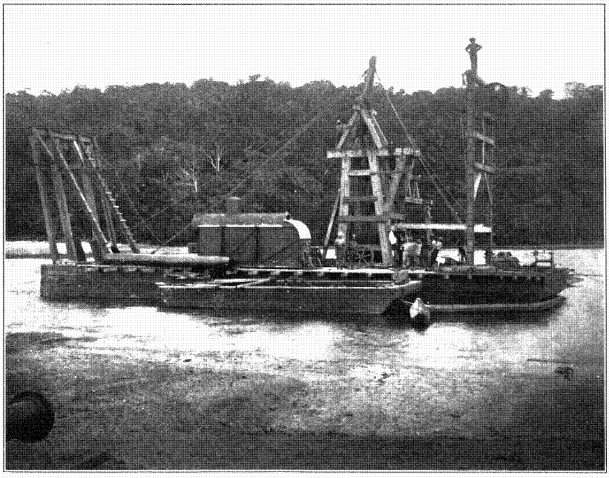


Fig. 2. A dredge in Ambos Camarines.

PLATE LXII.

LECTURES

A series of lectures by the director and staff of the Bureau of Science has been given under the auspices of the Manila Merchants' Association during the past year. These discussed some Philippine products and materials, and were as follows:

The Bureau of Science, its Meaning to the Commercial Public and its Work.
The Philippine Alcohol Industries.
Sugar Production in the Philippines.
Roads and Road Materials.
The Salt Production of the Philippines.
Gold Milling and Mills.

These lectures are to be published by the Manila Merchants' Association and bound in a memorial volume in commemoration of the late director of the Bureau of Science, Dr. Paul C. Freer, at whose suggestion they were given.

1912 PHILIPPINE EXPOSITION

Many of the lines of work of the Bureau of Science will not lend themselves to exhibition purposes, but in spite of this the exhibits were varied, foremost among which were demonstrations of the industrial operations of mining, fisheries, and silk culture. The culture of silk was of exceptionally popular interest. Racks supporting trays of silkworms in all stages of their existence, together with baskets of the cocoons, were displayed. The different varieties which have been most successfully propagated in the Philippines; namely, the Bengal-Ceylon and Philippine hybrid (Bengal-Japanese) and the Eri castorplant worms, were shown. Other portions of this exhibit had to do with all phases of the spinning and reeling of the silk by Filipina women.

The geological, mining, and metallurgical work of the Bureau was shown to very great advantage. For the first time all of the geological maps of the Archipelago were brought together in one large relief map showing the mountains, plains, and all the major features of Philippine geology. This map represents the accumulated data of over thirty years' work, the major portion of which has been performed within the past ten years by the division of mines of this Bureau. Separate relief models showed the physical features of the various well-known mining districts.

The output of various dredges and mines was graphically shown. Models showing the method of underground work in gold mines and the various stages of development and the manner of mining coal were exhibited.

A representative collection of Philippine rocks and minerals was displayed, above which were hung charts showing their economic distribution.

A very interesting display was that of the outfits used for catching big game fishes, which consisted of rods, lines, hooks, spoons, landing nets, gaffs, etc. As a graphical suggestion of the sport to be had in big game fishing in Philippine waters, four large fishes, caught during the past year on exploration trips in the waters south of Manila, were displayed. The examples shown were a Spanish mackerel weighing 30 kilograms, caught near the coast of Leyte; a jewfish or sea bass, weight 60 kilograms, caught at meander Reef; an ocean benito, weight 21 kilograms, caught at Apo Reef; and a giant pompano, weight 22 kilograms, caught off the coast of Palawan.

A very interesting and instructive exhibit was that of the products of oranges and coconuts. Samples of coconut oil, both crude and refined, and of soap manufactured from the same were valuable in showing the great possibilities of this industry. Samples of both sun-dried and kiln-dried copra were included in this exhibit. Fourteen bottles of orange juice produced from 100 oranges, orange peel, and paper manufactured from orange pulp were of special interest and suggest new Philippine industries.

Specimens of sand-lime brick in two sizes, manufactured from Philippine materials, were also displayed. These bricks, owing to the method of manufacture and hardening, withstand exceedingly severe tests. They promise to be a very satisfactory building material for the Philippines as there is no doubt of their strength and durability. They would suffice for a structure very much higher than is ordinarily built in the Archipelago.

There was included in the Bureau of Science exhibit a display of its various publications.

AQUARIUM

During the year the building for the aquarium, situated in the bastion immediately in front of the Real Gate of the city walls, has been practically completed and the grounds have been parked and are already very attractive. It has been discovered, however, that the glass which was intended for use in the aquaria is thinner than that used by most institutions and that it has a factor of safety of less than 2. For this reason it has been decided that the glass on hand will be kept in reserve for the future construction of smaller aquaria on the other

Fig. 1. Silk-reeling exhibition at the Philippine Carnival.

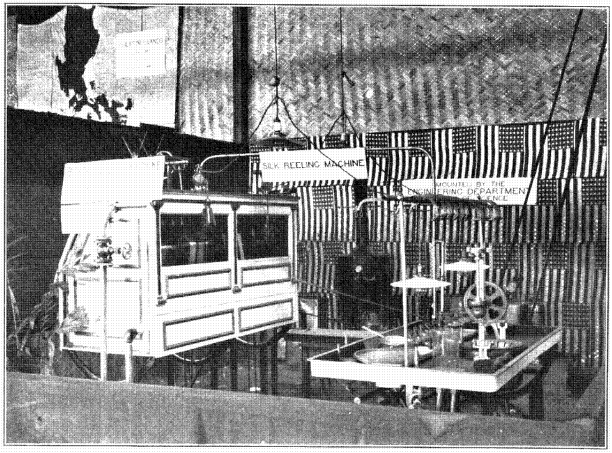


Fig. 2. Silk-reeling machine exhibited at the Philippine Carnival.

PLATE LXIII.

Fig. 1. Division of mines exhibit at the Philippine Carnival.

Fig. 2. Exhibit of Bureau of Science publications at the Philippine Carnival.

PLATE LXIV.

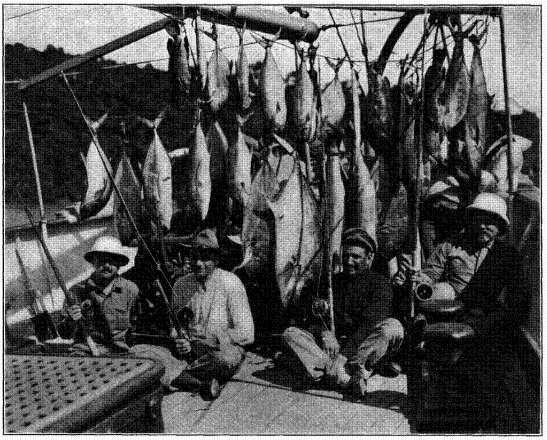


Fig. 1. A day's catch.
These fish were taken on December 12, 1911, in Malampaya Sound, by 4 fishermen working from 2 boats with 3 rods.

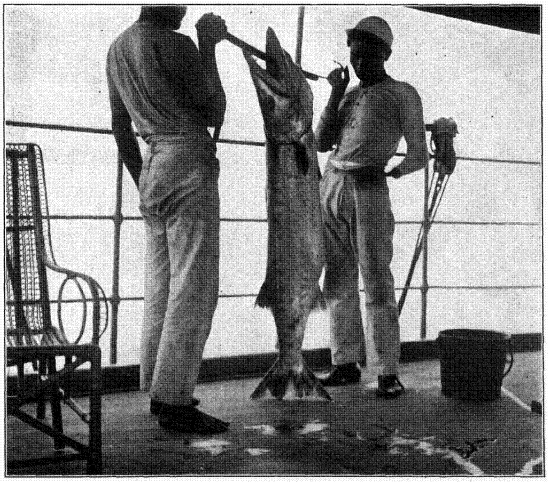
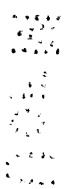


Fig. 2. A 110-pound rompe candado.

PLATE LXV.



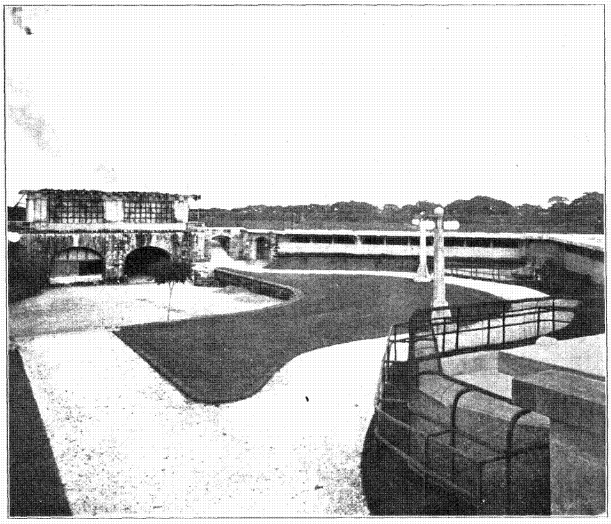


Fig. 1. Aquarium.

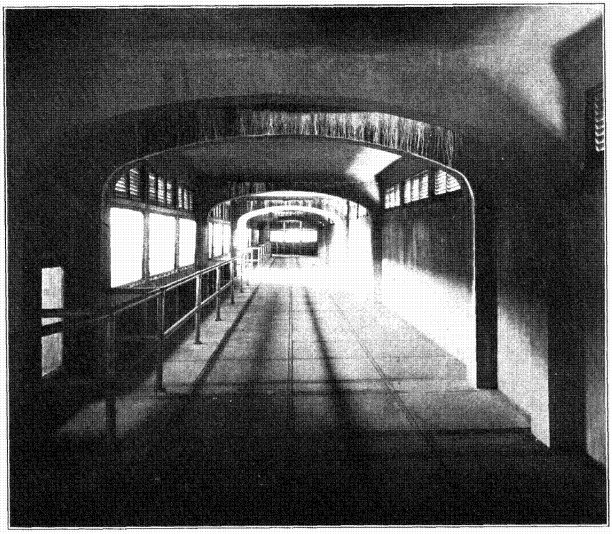


Fig. 2. Aquarium, showing main corridor.

PLATE LXVI.

side of the tunnel and that 1-inch glass be ordered for the present aquaria. The glass setting provided for in the plans of the Consulting Architect has proved troublesome in that it is very difficult to install the glass without producing internal strains. Such strains introduce a danger factor from cracking glass that no one interested cares to countenance. It has been decided that rigid iron frames should be constructed with planed surfaces against which the heavier glass will be placed. In this way internal strains will be avoided and the risk of glass breaking is obviated. The sum of ₱18,000 has been transferred to the Bureau of Science by the Governor-General from funds under his control for the completion of the building, and the work will be completed as quickly as possible. The glass has to be ordered from the United States, and the necessary iron frames constructed and installed. No roof was provided for the shark tanks. It is evident that this is necessary when we consider the fact that the average rainfall in the month of July is almost equal to the depth of the water in one of these tanks, so that each year in the month of July the salt water in the tanks, which is returned to our salt water reservoir, would be diluted by an equal amount of fresh water. No funds have been provided for operating this aquarium. Several minor changes will be made and the aquarium put in condition to operate as soon as possible, and an admission fee will be charged in the hope of making the aquarium self-supporting.

RECOMMENDATIONS

It has been three years since this Bureau has had an increase in appropriation in spite of the fact that the demands upon it have increased in every direction. There has been close coöperation and mutual confidence between the various laboratories of this Bureau and other institutions of the Government, but I regret that in many instances we have been unable to assist local professional and business men because of insufficient staff and apparatus. As shown by the statistics, the requests for routine work and for information, recommendation, and advice on scientific subjects have steadily increased in practically every division. The growth of this phase of our work has seriously interfered with our research, and handicapped us in carrying on new lines of investigation as well as completing those already begun. We are in sore need of more employees and laboratory space to carry the additional work entailed by the normal growth of this Bureau. Unless our appropriation is increased,

we cannot continue to develop. Our greatest usefulness is curtailed by lack of funds.

New testing laboratory.—The need of accommodations for a laboratory for testing all classes of materials used in the Islands has already been pointed out in the Tenth Annual Report. The importance of such tests and the saving of actual money to be effected by careful testing need not be emphasized as they are self-evident. Our greatest need is for enlarged accommodations for the testing laboratory. In 1907, the only kind of testing done in the Bureau of Science was that of cement and this only in a very small way. There were also cement-testing laboratories in the Bureau of Supply, at the City Hall, and under the supervision of the United States Army engineers. Up to that time little attention had been paid to the higher refinements of cement testing. The apparatus was generally limited, specifications incomplete, and the workmen inexperienced. The value of proper cement testing was appreciated by this Bureau, and preparations were made and research carried on to bring the work to a high degree of efficiency. Effects of local, tropical climatic conditions were carefully studied, and an endeavor was made to take into account in local cement specifications the differences between this and a temperate climate. This work largely overcame the obstacles of faulty specifications and prejudices, and in 1909 we were working with a full equipment and with specifications so modified that instead of a poor cement and dissatisfaction we were getting a good grade of cement under modified specifications equally satisfactory to the manufacturer, purchaser, and user. At the present time all of the cement testing of the Civil Government is done by this Bureau in a uniform manner. In 1906 we tested 14 cements; in 1907, one hundred eighty-five; in 1908, one thousand seven hundred nineteen; in 1909, three thousand five hundred ninety-six; in 1910, two thousand seven hundred seven; in 1911, six thousand five hundred forty-two, and during the first half of 1912 we tested four thousand five hundred sixty-three samples. In 1906, our authorized charge for cements was ₱30 per sample; in 1907, ₱15 per sample; and to-day it is only ₱0.60. During all of this time the average quality of the Portland cement imported has shown a decidedly increased efficiency, *our cement-testing laboratory has been self supporting, and no appropriation has ever been made for this work.* Delays due to the use of inferior cements have been greatly reduced.

At the present time we perform, as best we can with our

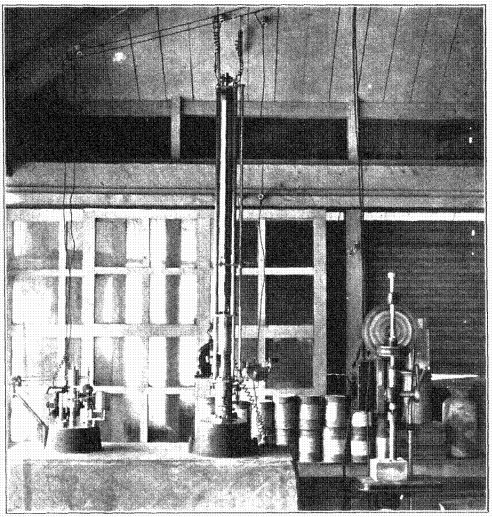


Fig. 1. Machines for testing road materials.

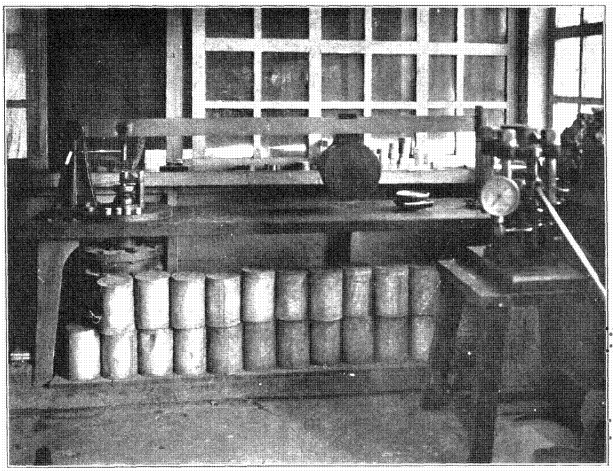


Fig. 2. Machines for testing road materials.

PLATE LXVII.

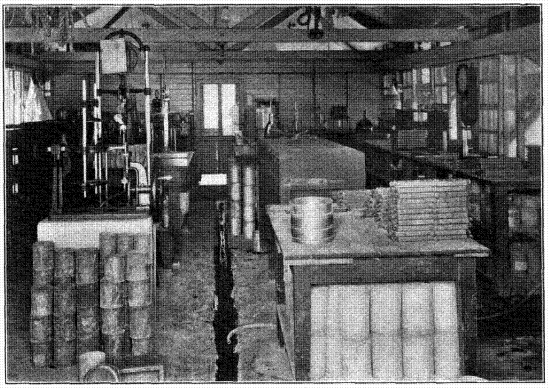


Fig. 1. Cement-testing laboratory.

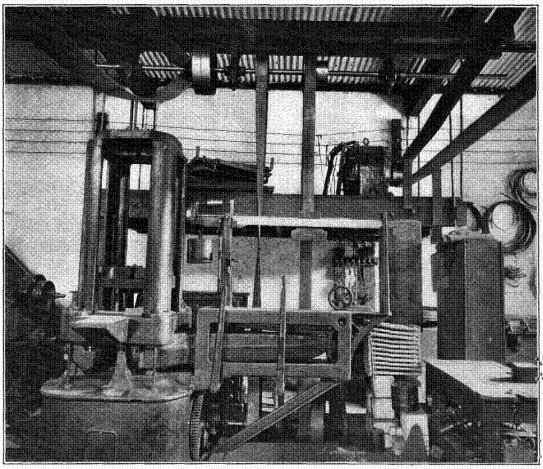


Fig. 2. Testing machine at Bilibid Prison.

PLATE LXVIII.

equipment, physical tests of a great many other materials such as reinforcing iron, steel, rope, wire, road materials, ties, cement pipes, concrete, mortar, building blocks, bricks, stones, cloth, and other similar materials. It is absolutely impossible for us to do the work that should be done with our present accommodations, and the small or decreasing number of requests for these tests does not represent the need or desire for information concerning the strength of such materials of construction. A great deal of this work can be done only with the testing machine which is now installed at Bilibid Prison. The inconvenient location and the high operating charges prohibit its use in the testing of materials except in exceptional cases. This 200,000-pound Olsen 4-screw press stands idle except for a few hours each year. Were it installed at the Bureau of Science, it would be utilized for hundreds of tests each week. I understand that this may be transferred to the Bureau of Science when we have a place in which to install it.

In 1908 the cement-testing laboratory was moved from its one small room in the main building to the calf stable which had been temporarily fitted up for the purpose. The installation of much-needed simple pieces of apparatus has so filled the laboratory that there is scarcely a half meter between any two pieces of apparatus, and other pieces of apparatus are installed under the overhanging eaves of other buildings and in various laboratories. The further installation of machinery is precluded owing to this overcrowded condition. There are a great many problems concerning construction materials besides cement, mortar, and concrete which should be worked out. Up to the present time we have been able to give very little time to the testing of tars, asphalts, pitches, dust preventatives, and natural and artificial building stones. The work done on these in a temperate climate is not applicable to the same material in this climate where it is used under entirely different conditions. We need more apparatus to do this, but we do not feel inclined to purchase the same until we have a place to install it when it arrives. All branches of the Government which have to deal with construction materials realize the importance of this work and the limited provision which has been placed at the disposal of this Bureau for carrying it on. The director of Public Works stated in an indorsement, dated April 23, 1912: "This Bureau recognizes the importance and necessity for scientific tests of all building construction material and believes that more adequate accommodations should be provided for this purpose. We will

be pleased to coöperate with the Bureau of Science in any extension or improvements which they may deem wise to undertake along this line."

In 1909 this Bureau first started ore testing. Two important tests were made during the year. The apparatus used was home-made and of too small capacity to furnish complete tests. We have since been enabled to perform tests on slightly larger samples, and to obtain results much more complete in cyanidization, amalgamation, and concentration. Several samples of ore from different parts of the Philippines and one from China have been sent in for treatment. A recently completed test demonstrates the importance of experimental work on large quantities of ore. The mine from which the sample was sent was operating at a loss due to trouble in cyaniding the ore. Within a week this Bureau was able to correct the difficulty, and the mine began profitable operation. This saved the company thousands of dollars, for if we had been unable to perform this test it would have been necessary to wait for reports from some laboratory in the United States, or to shut down the mill. While we are able to give some assistance now, we could perform complete amalgamation, concentration, and cyanide tests, if an adequate laboratory could be provided. The usefulness of a well-equipped ore-testing plant could scarcely be overestimated, although it would probably not pay expenses by its receipts for a long time; however, it would save the mining prospectors and operators thousands of dollars if we were equipped to give complete costs, capacities of machines, and actual figures on amalgamation, concentration, and cyanidization that would show to within a small percentage what could be expected from a mill. Work of this character would also indicate the most suitable mill for a given ore and thus prevent the installation of mills of a poor type, the chief cause of many failures in the Philippines.

I have given the subject of additional space for this work serious attention, and I believe that the only way in which it can be satisfactorily done is to add to the west end of the main building of the Bureau of Science a wing of the same dimensions as that which was begun on the east end two years ago. A wing of this size is exactly the dimension desired, and by reversing the internal arrangement would be that best suited to our needs. The front portion, corresponding to the space now occupied by the division of mines and the library, would provide accommodations for the testing laboratory; and the remaining space, corresponding to that occupied by the section of fisheries

on the first floor and the same space on the second floor, would provide accommodations for experimental work on large quantities of ore. Furthermore, by duplicating the present wing we could use the same plans and specifications, thus making a saving of approximately ₱5,000. John Gordan's contract for the wing was ₱82,128.61, steel beams and miscellaneous expenses amounted to ₱5,582.47, and ₱2,322.07 were paid for building inspection. These together amounted to ₱90,033.15. The value and importance to construction work alone warrants the expense of the laboratory. For instance, during one fiscal year 61,778,675 kilograms, or a value of ₱1,524,600, of Portland cement were imported into the Philippine Islands. At a low estimate, the total cost of the corresponding concrete was six times the cost of the cement, or ₱9,147,600. A gain or loss of 1 per cent in the efficiency of this material in durability and strength represents a money value of ₱91,476. This amount is amply sufficient to establish the desired laboratory. It would be most economical to use the plans already prepared for the east wing and build the west wing all at one time, but if it is feasible to build only the materials testing laboratory the north end might be closed with a thin wall so that the room for experimental work on large quantities of ores can be added subsequently as a separate project.

The Iloilo sugar laboratory.—The laboratory of the Bureau of Science at Iloilo was first opened for commercial analyses for a short period in 1909. The laboratory was little patronized and was run only intermittently for the first two years. The regular charge of ₱2 per sample of sugar was reduced to a special charge of ₱0.50 per sample in 1911, and to avoid the frequent discrepancies among the export houses of Iloilo their instruments and weights were corrected and standardized, and their employees were carefully instructed in methods of analysis. In 1911 the work of the laboratory increased so much that, in order to keep up with it, it was occasionally necessary to send assistance to the man regularly detailed there. During the last fiscal year the trade of the laboratory has exceeded by 100 per cent the figures of the previous year, and at the beginning of this year's season it was necessary to detail regularly a second man to assist with the work, thereby crippling the work in Manila.

Sugar growers are learning to appreciate more and more the value of this laboratory, and the work has grown to such magnitude that the small rented building and one chemist are not sufficient to handle it. There is every reason to believe that

the demands upon it will continue to grow as its helpfulness becomes more widely known. It seems to me that the need for the increased scope of the work is self-evident. The laboratory is being used, more and more, for umpire work in cases of disputes between buyers and sellers. This is a very important function, and within a very short time I believe it will be necessary to maintain it for a referee laboratory only; unquestionably so, unless provision is made for its support. The nominal charge of ₱0.50 does not pay the expense of the ordinary routine sugar polarization, not to mention the referee work. I believe the charge should be increased possibly to the old charge of ₱2 per sample.

I desire to call especial attention to the desirability of establishing an experimental station, preferably within easy access of the Iloilo laboratory, where cane from different countries can be compared and new varieties propagated. We should have greatly increased facilities and enough men to give advice as to the kind of cane that should be grown and the work that should be done to prevent its destruction by disease and insect pests. In all cane-producing countries, experimental stations have been established, and at some time in each instance these stations have been the means of saving the industry from serious setbacks. One very notable instance, the Bourbon cane in Demerara, may be cited. This cane was first planted in 1665 and was grown almost exclusively until 1905, when the rind disease practically exterminated this variety in a single year. If the experiment station had not been able to supply the farmers with points from a variety not susceptible to this disease, the industry would have received a serious handicap.

The laboratory should include equipment for the study of chemical and industrial problems in sugar and also for the investigation of soils, fertilizers, etc. In fertilization and irrigation the station should guide the planter. Under the old régime the planters have continuously practised for several hundred years a system of throttling cane growth by continuous planting, little plowing and cultivating, and no irrigation, in order to produce a small, rich cane stalk which could be used in their native processes. The larger centrals now being developed, and introduced into the Philippines, demand not only the sweet juice, but also the large stalk which can be obtained only by crop rotation, cultivation, and selection—methods in which the planters are little versed.

Several new mills will be in operation on the Island of Negros

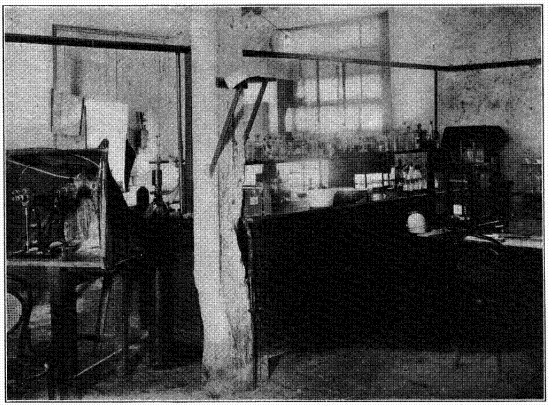


Fig. 1. Iloilo sugar laboratory.

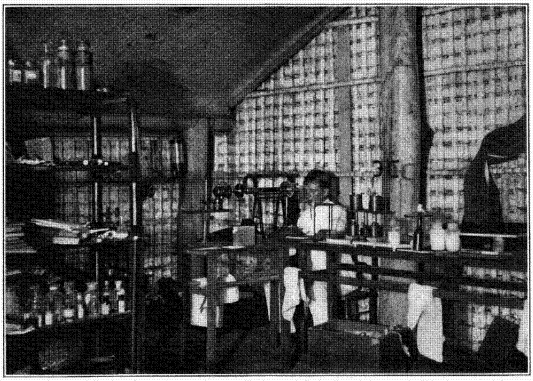


Fig. 2. Temporary field-sugar laboratory.

PLATE LXIX.

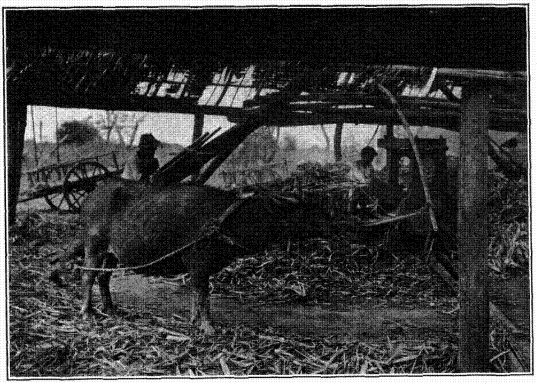


Fig. 1. A carabao mill.

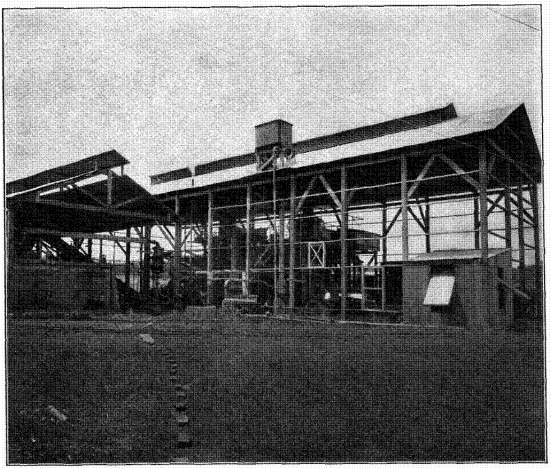


Fig. 2. A modern sugar mill.

PLATE LXX.

within a short time; and the assistance of scientific men will greatly add to their success. The chemical, industrial, and agricultural work must go hand in hand. In whatever way these three different branches of experimental work are carried on in the future, there must be the closest harmony. Men thoroughly trained and experienced in sugar experimental work are not easily obtained, and it would probably not be possible for us to pay salaries in the beginning that would get such men, but, if the work could be started now and we could get young, well-trained men, they could grow up with the work and we could probably make more progress than in any other way. To build such laboratories as are necessary for the chemical and experimental work, ₱100,000 would probably be required, but the Government, whether it owns its laboratory or not, should make a special effort at this time to have trained men to assist in the industrial and chemical work and in the selection and propagation of the proper varieties of cane. In order properly to do this, we should have a sugar division under the charge of a head chemist, and at least two assistant chemists should be provided. The sum of ₱15,000 per year should be appropriated for this purpose. If a suitable experimental farm should be provided and funds for its equipment and maintenance appropriated, the entomologists and botanists of the Manila laboratory temporarily could assist with experimental work until such time as it becomes necessary to maintain these scientists permanently for this work. Experimental work carried on in Iloilo should assist the growers of both north and south and would be a big factor in the future of the sugar-cane industry of the Philippine Islands. However, sooner or later, it would probably be desirable to establish an experiment station in Pampanga or Pangasinan which could cooperate with the Manila laboratory. Eventually it might be desirable to establish several branch experimental farms in various parts of the Islands, because a cane that thrives in one district may be very disappointing in another. This experimentation is most important and vital to the sugar industry of the Islands, for to-day the average hectare yields less than 3 tons, whereas in other sugar-producing countries a crop of that size is not considered exceptional for an acre (0.4 hectare), and in every case the high production has been wrought by careful experiments, extended over many years. The results of experimentation of this nature are hardly apparent for several years, and the longer the work is delayed, the greater will be the loss and the slower will be the development of the sugar industry.

We have very little data with regard to the exact quality of sugar being exported from the Philippine Islands. A law compelling a polarization of each 10 tons of sugar leaving the Islands would give data valuable to the development of the industry. A careful and systematic study of the quality of the sugars now produced and the application of scientific knowledge to improve the product would enormously increase its quality and value.

Coöperative work.—The work which the Bureau of Science is carrying on at the request of the Board of Regents in the College of Medicine and Surgery and the College of Liberal Arts of the University has been ably pointed out in the Tenth Annual Report. We have detailed our best men to do this work, and the University has received better instructors than it could have obtained otherwise. We have been glad to do this because we have been able to give additional remuneration to men whose merits have long been recognized. The objection to the plan is, of course, that a certain amount of time of the best men is taken away from their research work, and others have become more or less discontented due to the belief that men are more rapidly advanced in the University than in the Bureau of Science. There should be no discrimination between these institutions of the Government, and the appropriation for salaries and wages in the Bureau of Science should be just as liberal as in any of the others. It is recommended that an appropriation of ₱30,000 be added to that of the Bureau of Science, in order that parallel salaries may be maintained between this institution and other branches of the Government.

Soil surveys.—In a fundamentally agricultural country like the Philippines, the need of investigating all of the conditions upon which plant growth depends can scarcely be overestimated. We have accumulated a large amount of data which have been published in the Philippine Journal of Science and these data, together with those of an unpublished contribution from the division of general, inorganic, and physical chemistry, enable us to obtain a somewhat comprehensive view of the subject. With few exceptions the soils of this country are all inherently suited to the growth and maintenance of crops, and the subject of the chemical analyses of soils is not of as great value as is generally supposed. More important considerations are a study of the geological formation, the physical properties, light intensity, rainfall, humidity, and the circulation and composition of the soil moisture. As was stated in the Tenth Annual Report, "a geo-

logical examination of a given region, combined with a mechanical analysis of the soils and a study of the rainfall and of the water courses, will have more bearing on the understanding of the specific crops adapted to the district than any number of chemical analyses. This is especially true of the Philippines where we encounter virgin soils and where the geology of the country is undergoing rapid change." I wish to reiterate the recommendation that "a soil survey in the Philippine Islands in relation to the best crops to be grown in certain regions be taken up from this comprehensive standpoint," and that sufficient funds be provided to enable geologists, chemists, meteorologists, and botanists to be detailed to the work. A detailed study of the relation of the distribution of the vegetation to environmental conditions on Mount Maquiling has been begun by this Bureau. Work of this character will have more influence on agriculture than detailed analyses.

Animal diseases.—One of the imperative needs of this country is a thorough pathological and bacteriological investigation of the subject of animal diseases, and it is desirable to have a fund for carrying on such a study in the Bureau of Science. The Government is already provided with excellent equipment in the biological laboratory of this Bureau. An increase in our pathological and bacteriological staff would enable us to make such an investigation with the least possible expense. During the past year we have continued our study of surra, but have been unable to carry on many of the more important and practical problems presented by this disease on account of the lack of large animals and screened stables for experimentation. The extent to which animals have ability to become carriers of organisms pathogenic to man needs to be worked out. This question as well as that of human carriers is a very important one.

Insects injurious to agricultural products.—During the past year this Bureau has been experimenting with the insects infesting tobacco and has worked out a means of preventing the ravages of the cigarette beetle (*Lasioderma serricorne*) in the finished product of the factory. It was necessary to work out the life history of this beetle in order to discover the means of eradicating it from the product. Such work should be carried on much faster than it is possible for the Bureau of Science to do with its two entomologists. There are other tobacco insects and insects which attack other agricultural crops, as well, which should be studied. I believe that when funds are available for

entomological work they should be appropriated to this Bureau which has done the pioneer work on locusts in the Philippines and on the other insects which infest crops.

Republishing.—The question of the advisability of republishing some of the books issued by this Bureau, which are out of print or of which the edition is nearly exhausted, has often been discussed. The supply of copies of the Bontoc Igorot has this year been exhausted, and it would seem to me very desirable that it be revised and reprinted, as the demand for it continues. A recommendation has been made in previous years that a reimbursable fund be established for this purpose so that the charge may not be an expense entirely against one fiscal year. This plan is one which could be very easily put into practice. It would seem advisable, if the legislature desires to take up the question of republishing at all, to appropriate a fund sufficient to cover the expense of reissuing such publications and to make this fund a permanent one to be reimbursed from the sales of the second editions of the publications.

Library.—For the past seven years the central scientific library for all the Bureaus of the Department of the Interior has been in the Bureau of Science. It is our duty to maintain the library facilities and, also, to purchase books in so far as our funds will permit. During the year we have accessioned a number of bound volumes and a few subscriptions for journals. The latter must be bound. In order to keep up with the binding, it is necessary that we bind about 2,000 volumes annually. During the past year our binding bills amounted to ₱8,400; our subscriptions amounted to about ₱3,791.39; making a total expense of over ₱12,191.39 during the last fiscal year before any books or sets are purchased at all. We have a number of incomplete sets in the library, and for this reason the value of these books is considerably reduced. The books necessary to complete the sets are becoming more scarce each year, and some of them double in price in a single year. It would be desirable from a purely monetary point of view for the Government to complete its sets immediately even if the books were not needed at present. It would cost about ₱50,000 to complete the incomplete sets which are now in the library, and this would be an advisable expenditure if funds were available. Aside from filling the incomplete sets, the library must expand to meet the demands upon it. The mere necessities cannot suffice. Our library is weak in those lines which are now departments of the University along which work has not already been carried on in the Bureau of Science.

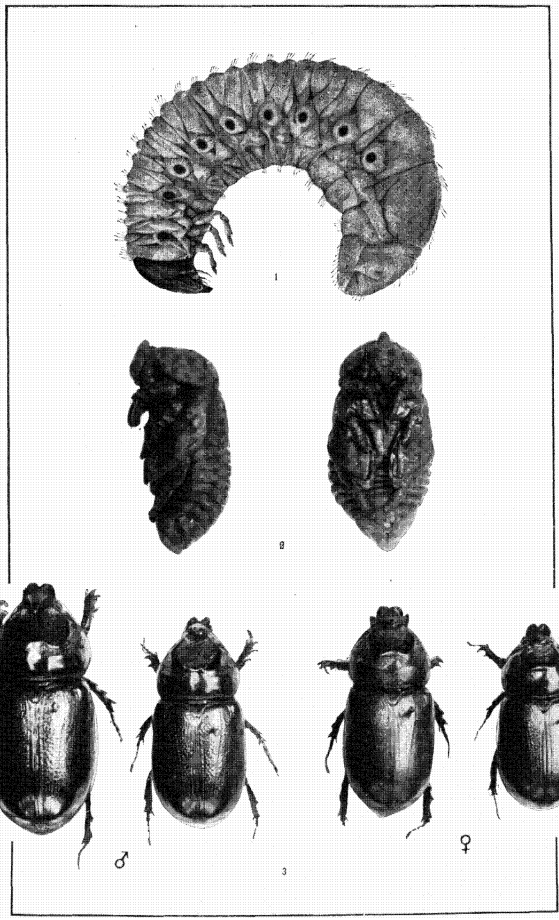


Fig. 1. Larva of *Oryctes rhinoceros* L.
Fig. 2. Pupa of *Oryctes rhinoceros* L.
Fig. 3. Adults, male and female, of *Oryctes rhinoceros* L.

PLATE LXXI.

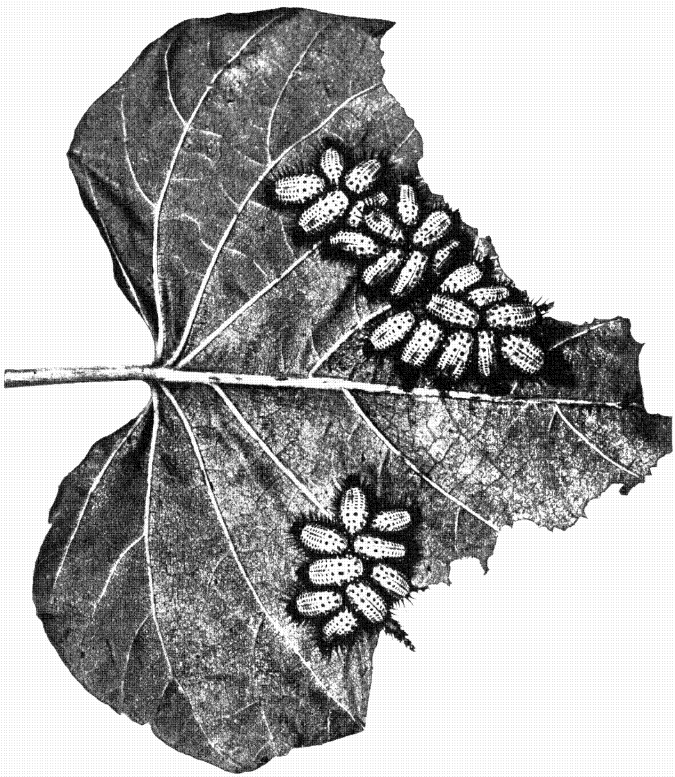


PLATE LXXII. GROUPS OF LARVÆ OF *Asopidomorpha miliaris* Fabr., NATURAL SIZE.

It is recommended that a suitable amount be added to the appropriation of the Bureau of Science in order that we may keep up our subscriptions to current scientific periodicals and keep our volumes bound and in shape for ready reference.

Fisheries.—The advisability and necessity of enlarging the scope of our present work on the fish and fisheries of the Philippine Islands has been emphasized in previous reports. This industry could be materially developed if we were able to secure the services of one or two additional men.

Tables showing the routine work performed and supplies manufactured and disposed of during the fiscal year 1911–12 by the Bureau, and a financial statement showing the appropriation and how it was expended are attached hereto.

ALVIN J. COX,
Acting Director, Bureau of Science.

To the Honorable,
The SECRETARY OF THE INTERIOR.

TABLE I.—*Comparative table of routine work performed and supplies manufactured and disposed of during the fiscal year 1912, as compared with the fiscal year 1911, by number or quantity.*

[July 1, 1912.]

Division of the Bureau.	Samples or units.		Decrease.	Increase.
	1911	1912		
General, inorganic, and physical chemistry:				
Metals and alloys		36		
Rocks, minerals, natural pigments, and similar substances		46		
Clays, shales, limestone, lime, wall plasters, cement, and slags		83		
Fertilizers		16		
Soils and similar substances		61		
Coal analyses		20		
Steaming tests		2		
Calorimetric tests of fuels		8		
Waters		146		
Crude chemical and miscellaneous analyses		33		
Standard solutions		33		
Physical test of wire, twine, fiber, textile paper, and similar articles		14		
Cements		8,476		
Compression, tensile, or transverse strength of concrete, stone, mortar, rope, iron and steel, etc		221		
Standardization of road materials		27		
Standardization of units of measures—				
Lengths				
Capacities		370		
Weights		620		
Miscellaneous		156		
Total	5,998	10,368		4,370
Organic chemistry:				
Urines, clinical and toxicological analyses	494	6,143		5,649
Essential oils and essences		6		6
Petroleum and products, copra, and similar materials		17		17
Paints, varnishes, and linseed oils	127	41	86	
Gums, resins, and similar materials		1		1
Paper and similar materials		126		126
Gastric juice, clinical examinations		7		7
Foods, alcohol, and beverages	1,049	1,288		239
Food preservatives and coloring matters		32		32
Medicines and similar articles		84		84
Miscellaneous		91		91
Total	1,670	7,836		6,162
Mines:				
Assays	1,525	413	1,112	

TABLE I.—*Comparative table of routine work, etc., by quantity*—Continued.

Division of the Bureau.	Samples or units.		Decrease.	Increase.
	1911	1912		
Biological laboratory:				
Fæces	14,223	21,684		7,461
Sputum	780	3,861		3,081
Blood	275	2,976		2,701
Gonococci	13,997	15,971		1,974
Waters	360	742		382
Necropsies	238	54	184	
Miscellaneous	5,772	3,482	2,290	
Total	35,645	48,770		13,125
Serum section of the biological laboratory:				
Vaccine virus (doses)—				
Prepared	3,451,436	2,148,186	1,303,250	
Disposed of	3,274,579	2,107,359	1,167,220	
Antirinderpest serum (cubic centimeters) —				
Prepared	5,876,000		5,876,000	
Disposed of	5,451,666	694,666	4,757,000	
Plague prophylactic (cubic centimeters)—				
Prepared				
Disposed of	2,250		2,250	
Mallein (doses)—				
Prepared	473	532		59
Disposed of	585	641		56
Diphtheria antitoxin (units)—				
Prepared	234,000	639,000		405,000
Disposed of	291,500	475,500		184,000
Tetanus antitoxin (units)—				
Prepared	610,250	1,821,700		1,211,450
Disposed of	625,000	894,500		269,500
Cholera prophylactic (cubic centimeters)—				
Prepared				
Disposed of	30		30	
Antiplague serum (cubic centimeters)—				
Prepared		60		60
Disposed of	690	60	630	
Anticholera serum (cubic centimeters)—				
Prepared	800		800	
Disposed of	1,626		1,626	
Antidysentery serum (cubic centimeters)—				
Prepared	780	1,950		1,070
Disposed of	720	780		60
Antityphoid serum (cubic centimeters)—				
Prepared		52		52
Disposed of	15	1	14	
Tuberculin, human (cubic centimeters)—				
Prepared	570	575		5
Disposed of	536	328	208	
Tuberculin, bovine (cubic centimeters)—				
Prepared	191	224		33
Disposed of	152	61	91	

TABLE I.—*Comparative table of routine work, etc., by quantity*—Continued.

Division of the Bureau.	Samples or units.		Decrease.	Increase.
	1911	1912		
Serum section of the biological laboratory—Ctd.				
Antigonococcus prophylactic (cubic centimeters)—				
Prepared	187		187	
Disposed of	197		197	
Antistaphylococcus prophylactic, aureus and albus (cubic centimeters)—				
Prepared	168		168	
Disposed of	188		188	
Normal horse serum (cubic centimeters)—				
Prepared	11,200	25,160		13,960
Disposed of	12,262	990	11,272	
Normal salt solution (liters)—				
Prepared				
Disposed of		2		2
Typhoid vaccine (cubic centimeters)—				
Prepared				
Disposed of	9		9	
Tuberculin vaccine (cubic centimeters)—				
Prepared	175		175	
Disposed of	175		175	
"A" serum for exophthalmic goiter (cubic centimeters)—				
Prepared	35		35	
Disposed of				
"B" serum for exophthalmic goiter (cubic centimeters)—				
Prepared	200		200	
Disposed of	10		10	
Rabies vaccine (doses)—				
Prepared	404		404	
Disposed of	279		279	
Anthrax vaccine No. I (cubic centimeters)—				
Prepared				
Disposed of	39		39	
Anthrax vaccine No. II (cubic centimeters)—				
Prepared				
Disposed of	90		90	
Staphylococcus vaccine (cubic centimeters)—				
Prepared		406		406
Disposed of		456		456
Antigonococcus vaccine (cubic centimeters)—				
Prepared		370		370
Disposed of		274		274
Normal rabbit serum (cubic centimeters)—				
Prepared				
Disposed of				

TABLE I.—*Comparative table of routine work, etc., by quantity*—Continued.

Division of the Bureau.	Sample or units.		Decrease.	Increase.
	1911	1912		
Serum section of the biological laboratory—Ctd.				
Autogenous staphylococcus vaccine (cubic centimeters)—		20		20
Prepared				
Disposed of		385		385
Miscellaneous:				
Photographs	21,194	9,349	11,845	
Natural history specimens	598	34	564	
Shop orders	210	243		33
Miscellaneous work	45	34	11	
Total	22,047	9,660	12,387	

TABLE II.—*Comparative table of routine work performed (free and cash) and supplies manufactured and sold during the fiscal year 1912, as compared with the fiscal year 1911, by value.*

[July 1, 1912.]

Division of the Bureau.	1911	1912	Decrease.	Increase.
General, inorganic, and physical chemistry:				
Metals and alloys		₱187.50		
Rocks, minerals, natural pigments, and similar substances		624.00		
Clays, shales, limestone, lime, wall plasters, cement, and slags		916.44		
Fertilizers		142.30		
Soils and similar substances		1,691.00		
Coal analyses		346.00		
Steaming tests		120.00		
Calorimetric tests of fuels		160.00		
Waters		4,800.00		
Crude chemical and miscellaneous analyses		344.80		
Standard solutions		150.50		
Physical test of wire, twine, fiber, textile paper, and similar articles		14.00		
Cements		6,738.80		
Compression, tensile, or transverse strength of concrete, stone, mortar, rope, iron, steel, etc.		436.50		
Standardization of road materials		132.50		
Standardization of units of measures:				
Lengths				
Capacities		194.80		
Weights		71.58		
Miscellaneous		114.22		
Total	₱15,137.01	17,184.94		₱2,047.93

TABLE II.—*Comparative table of routine work, etc., by value*—Continued.

Division of the Bureau.	1911	1912	Decrease.	Increase.
Organic chemistry:				
Urine, clinical and toxicological analyses	₱1,571.00	[a] ₱18,632.00		[a] ₱17,061,00
Essential oils and essences		48.50		48.50
Petroleum and products, copra, and similar materials		278.00		278.00
Paints, varnishes, and linseed oils	1,895.50	453.88	₱1,441.62	
Gums, resins, and similar materials		7.00		7.00
Paper and similar materials		1,260.00		1,260.00
Gastric juice, clinical examinations		525.00		525.00
Foods, alcohols, and beverages	10,770.00	11,322.50		552.50
Food preservatives and coloring matters		440.00		440.00
Medicines and similar articles		526.00		526.00
Miscellaneous		812.50		812.50
Total	14,236.50	[a] 34,305.38		[a] 20,068.88
Mines:				
Assays	3,426.05	895.75	2,530.30	
Biological laboratory:				
Fæces	136,388.00	138,667.00		2,279.00
Sputum	2,340.00	11,553.00		9,213.00
Blood	1,137.00	17,545.00		16,408.00
Gonococci	41,994.00	47,913.00		5,919.00
Waters	13,531.00	28,910.00		15,379.00
Necropsies	5,950.00	1,350.00	4,600.00	
Miscellaneous	22,214.00	11,748.00	10,466.00	
Total	223,554.00	257,686.00		34,132.00
Serum section of the biological laboratory:				
Vaccine virus	31,764.27	21,800.22	9.964.05	
Antirinderpest serum	11,656.66	1,190.78	10,465.88	
Mallein	536.70	591.50		54.80
Miscellaneous sera and preparations	1,878.43	3,502.45		1,624.02
Total	45,836.06	27,084.95	18.751.11	
Miscellaneous:				
Photographs	5,878.19	5,525.02	353.17	
Natural history specimens	261.22	91.50	169.72	
Shop orders	206.92	1,588.11		1,381.19
Miscellaneous work	1,027.56	1,389.30		361.74
Supplies	2,044.34	3,018.17		973.83
Total	9,418.23	11,612.10		2,193.87
Grand total	311,607.85	348,769.12		37,161.27

[a] Includes all urines examined by the biological laboratory.

TABLE III.—*Comparative table of cash receipts for the fiscal year 1912, as compared with the fiscal year 1911.*

[July 1, 1912.]

Division of the Bureau.	1911	1912	Decrease.	Increase.
General, inorganic, and physical chemistry:				
Metals and alloys		₱72.00		
Rocks, minerals, natural pigments, and similar substances		79.00		
Clays, shales, limestone, lime, wall plasters, cement, and slags		738.44		
Fertilizers		108.30		
Soils and similar substances		731.00		
Coal analyses		138.00		
Steaming tests				
Calorimetric tests of fuels		80.00		
Waters		410.00		
Crude chemical and miscellaneous analyses		236.80		
Standard solutions		7.50		
Physical test of wire, twine, fiber, textile paper, and similar articles				
Cements		6,738.80		
Compression, tensile, or transverse strength of concrete, stone, mortar, rope, iron, steel, etc		368.50		
Standardization of road materials		110.50		
Standardization of units of measures—				
Lengths				
Capacities		13.00		
Weights		65.18		
Miscellaneous		103.22		
Total	₱8,369.01	10,000.24		₱1,631.23
Organic chemistry:				
Urines, clinical and toxicological analyses	356.00	[a]1,381.00		[a]1,025.00
Essential oils and essences		32.50		32.50
Petroleum and products, copra, and similar materials		78.00		78.00
Paints, varnishes, and linseed oils	1,436.00	229.75	₱1,206.25	
Gums, resins, and similar materials		7.00		7.00
Paper and similar materials				
Gastric juice, clinical examinations		375.00		375.00
Foods, alcohols, and beverages	1,277.00	1,838.00		561.00
Food preservatives and coloring matters		5.00		5.00
Medicines and similar articles		73.00		73.00
Miscellaneous		409.50		409.50
Total	3,069.00	[a]4,428.75		[a]1,359.75
Mines:				
Assays	3,285.05	832.00	2,453.05	

[a] Includes all urines examined by the biological laboratory.

TABLE III.—*Comparative table of cash receipts, etc.*—Continued.

Division of the Bureau.	1911	1912	Decrease.	Increase.
Biological laboratory:				
Fæces	₱603.00	₱1,172.00		₱569.00
Sputum	24.00	153.00		129.00
Blood	187.00	2,184.00		1,997.00
Gonococci	12.00	6.00	₱6.00	
Waters	70.00	480.00		410.00
Necropsies				
Miscellaneous	71.00	42.00	29.00	
Total	967.00	4,037.00		3,070.00
Serum section of the biological laboratory:				
Vaccine virus	31,764.27	21,800.22	9,964.05	
Antirinderpest serum	11,656.66	1,190.78	10,465.88	
Mallein	536.70	591.50		54.80
Miscellaneous sera and preparations	1,878.43	3,502.45		1,624.02
Total	45,836.06	27,084.95	18,751.11	
Miscellaneous:				
Photographs	3,643.63	4,873.82		1,230.19
Natural history specimens	261.22	91.50	169.72	
Shop work	206.92	419.95		213.03
Miscellaneous work	1,027.56	1,389.30		361.74
Supplies	2,044.34	3,018.17		973.83
Sale of documents	5,588.50	7,452.06		1,863.56
Refunded work not done, etc. (deducted)	44.10	109.22		65.12
Power, gas, etc	13,848.79	28,766.35		14,917.56
Reimbursement of traveling expenses, etc		4,131.50		4,131.50
Total	26,665.06	50,251.87		23,586.81
Grand total	88,191.18	96,634.81		8,443.63

TABLE IV.—*Showing free and cash work performed and supplies sold to the various departments of the Government for the fiscal year 1912.*

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Bureau of Health:				
Rocks, minerals, natural pigments, and similar substances	1	₱10.00		₱10.00
Standard solutions	2		₱7.50	7.50
Standardization of units of measures:				
Miscellaneous	6	6.00		6.00
Urines, clinical and toxicological analyses	3,583	9,767.00	1,007.00	10,774.00
Paints, varnishes, and linseed oils	1	5.00		5.00
Gastric juice, clinical examinations	2	150.00		150.00
Foods, alcohols, and beverages	617	8,686.00	19.00	8,705.00
Food preservatives and coloring matters	31	435.00		435.00
Medicines and similar articles	3	15.00		15.00
Miscellaneous chemical analyses and examinations	14	137.00	34.50	171.50

TABLE IV.—*Showing free and cash work, etc.*—Continued.

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Bureau of Health—Continued.				
Waters—				
Chemical	39	₱1,230.00		₱1,230.00
Biological	636	25,115.00		25,115.00
Fæces	6,882	93,746.00	₱740.00	94,486.00
Sputum	506	1,404.00	84.00	1,488.00
Blood	2,437	13,816.00	1,341.00	15,157.00
Gonococci	15,969	47,907.00		47,907.00
Necropsies	14	350.00		350.00
Miscellaneous biological work and examinations	3,425	11,549.00		11,549.00
Vaccine virus	2,057,672		20,576.72	20,576.72
Miscellaneous sera and preparations	533,916½		1,254.90	1,254.90
Photographic work	937		710.60	710.60
Shop work	34		127.74	127.74
Supplies	34		202.69	202.69
Total	2,626,761½	214,328.00	26,105.65	240,433.65
Bureau of Supply:				
Metals and alloys	1	10.00		10.00
Coal analyses	9	180.00		180.00
Steaming tests	2	120.00		120.00
Calorimetric tests of fuels	4	80.00		80.00
Crude chemical and miscellaneous analyses	3	11.00		11.00
Physical test of wire, twine, fiber, textile paper, and similar articles	14	14.00		14.00
Cements	6,062		3,637.80	3,637.80
Compression, tensile, or transverse strength of concrete, stone, mortar, rope, iron, steel, etc	11		60.00	60.00
Standardization of road materials	2		10.00	10.00
Standardization of units of measures—				
Capacities	370	181.80	13.00	194.80
Weights	34	3.40		3.40
Miscellaneous	137	5.00	56.22	61.22
Essential oils and essences	1	3.00		3.00
Petroleum and products, copra, and similar materials	10	200.00		200.00
Paints, varnishes, and linseed oils	14	138.00	16.25	154.25
Foods, alcohols, and beverages	3	30.00		30.00
Medicines and similar articles	1	5.00		5.00
Miscellaneous chemical analyses and examinations	16	135.00		135.00
Waters—				
Chemical	25	560.00		560.00
Biological	26	735.00		735.00
Photographic work	242		230.40	230.40
Shop work	1		9.00	9.00
Supplies	8		61.46	61.46
Miscellaneous work	4		24.00	24.00
Total	7,000	2,411.20	4,118.13	6,529.33

TABLE IV.—*Showing free and cash work, etc.*—Continued.

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Bureau of Public Works:				
Rocks, minerals, natural pigments, and similar substances	1		₱6.50	₱6.50
Clays, shales, limestone, lime, wall plasters, cement, and slags	2		24.00	24.00
Cements	2,073		2,073.00	2,073.00
Compression, tensile, or transverse strength of concrete, stone, mortar, rope, iron, steel, etc	161		181.50	181.50
Standardization of road materials	9		44.50	44.50
Essential oils and essences	1	₱7.00		7.00
Paints, varnishes, and linseed oils	2	22.50		22.50
Miscellaneous chemical analyses and examinations	9	5.00	16.00	21.00
Waters—				
Chemical	49	1,935.00		1,935.00
Biological	49	1,960.00		1,960.00
Photographic work	92		184.00	184.00
Supplies	1		0.41	0.41
Total	2,449	3,929.50	2,529.91	6,459.41
Bureau of Prisons:				
Cement	1		3.00	3.00
Urine, clinical and toxicological analyses	2,463	7,416.00		7,416.00
Foods, alcohols, and beverages	1	5.00		5.00
Medicines and similar articles	1	10.00		10.00
Miscellaneous chemical analyses and examinations	1	5.00		5.00
Waters, biological examinations	6	150.00		150.00
Fæces	14,532	43,596.00		43,596.00
Sputum	3,326	9,978.00		9,978.00
Blood	469	1,449.00		1,449.00
Necropsies	40	1,000.00		1,000.00
Miscellaneous biological work and examinations	31	100.00		100.00
Miscellaneous sera and preparations	60		60.00	60.00
Photographic work	4		0.80	0.80
Total	20,935	63,709.00	63.80	63,772.80
Bureau of Customs:				
Metals and alloys	25	70.50		70.50
Fertilizers	2	30.00		30.00
Crude chemical and miscellaneous analyses	6	42.00	5.00	47.00
Compression, tensile, or transverse strength of concrete, stone, mortar, rope, iron, steel, etc	1	5.00		5.00
Essential oils and essences	1	6.00		6.00
Paints, varnishes, and linseed oils	7	58.63		58.63
Paper and similar materials	8	80.00		80.00
Foods, alcohols, and beverages	17	115.00		115.00

TABLE IV.—*Showing free and cash work, etc.*—Continued.

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Bureau of Customs—Continued.				
Medicines and similar articles	50	₱293.00		₱293.00
Miscellaneous chemical analyses and examinations	1	6.00		6.00
Total	118	706.13	₱5.00	711.13
Bureau of Internal Revenue:				
Standardization of units of measures:				
Weights	3	3.00		3.00
Foods, alcohols, and beverages	32	485.00		485.00
Medicines and similar articles	18	130.00		130.00
Miscellaneous chemical analyses and examinations	2	4.00		4.00
Total	55	622.00		622.00
Executive Bureau:				
Waters—				
Chemical	5		175.00	175.00
Biological	5		200.00	200.00
Photographic work	32		27.00	27.00
Supplies	1		2.70	2.70
Total	43		404.70	404.70
Bureau of Justice:				
Metals and alloys	1		14.00	14.00
Urines, clinical and toxicological analyses	1		3.00	3.00
Gastric juice, clinical examinations	4		300.00	300.00
Medicines and similar articles	4		25.00	25.00
Miscellaneous chemical analyses and examinations	1		20.00	20.00
Total	11		362.00	362.00
Bureau of Education:				
Metals and alloys	1	8.00		8.00
Photographic work	965		310.02	310.02
Total	966	8.00	310.02	318.02
Bureau of Printing:				
Paper and similar materials	118	1,180.00		1,180.00
Assays	1	6.00		6.00
Photographic work	15		3.00	3.00
Total	134	1,186.00	3.00	1,189.00
Bureau of Agriculture:				
Soils and similar substances	14	630.00		630.00
Food, alcohols, and beverages	8	27.50		27.50
Waters—				
Chemical	1	40.00		40.00
Biological	1	40.00		40.00
Antirinderpest serum	694, 666⅔		1,190.78	1,190.78
Mallein	40		4.00	4.00
Photographic work	154		62.60	62.60
Supplies	65		39.76	39.76
Total	694, 949⅓	737.50	1,297.14	2,034.64

TABLE IV.—*Showing free and cash work, etc.*—Continued.

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Bureau of Forestry:				
Soils and similar substances	3	₱90.00		₱90.00
Standardization of units of measures, miscellaneous	5		₱5.00	5.00
Photographic work	87		46.40	46.40
Total	95	90.00	51.40	141.40
Bureau of Navigation:				
Rocks, minerals, natural pigments, and similar substances	1	10.00		10.00
Cements	30		60.00	60.00
Compression, tensile, or transverse strength of concrete, stone, mortar, rope, iron, steel, etc	9	45.00		45.00
Waters, biological examinations	2	80.00		80.00
Supplies	5		5.89	5.89
Total	47	135.00	65.89	200.89
Bureau of Quarantine Service:				
Urines, clinical and toxicological analyses	1	2.00		2.00
Fæces	6	150.00		150.00
Sputum	1	3.00		3.00
Blood	2	6.00		6.00
Miscellaneous biological work and examinations	19	57.00		57.00
Vaccine virus	8,800		88.00	88.00
Supplies	1		7.50	7.50
Total	8,830	218.00	95.50	313.50
Weather Bureau:				
Waters—				
Chemical	4	135.00		135.00
Biological	3	70.00		70.00
Total	7	205.00		205.00
College of Medicine and Surgery, University of the Philippines:				
Urines, clinical and toxicological analyses	10	36.00		36.00
Foods, alcohols, and beverages	10	50.00		50.00
Miscellaneous chemical analyses and examinations	15	75.00		75.00
Waters, chemical analyses	2	10.00		10.00
Miscellaneous sera and preparations	640		158.00	158.00
Photographic work	247		105.90	105.90
Shop work	2		9.23	9.23
Supplies	225		275.06	275.06
Total	1,151	171.00	548.19	719.19
College of Agriculture, University of the Philippines:				
Supplies	2		3.71	3.71

TABLE IV.—*Showing free and cash work, etc.*—Continued.

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Philippine Constabulary:				
Compression, tensile, or transverse strength of concrete, stone, mortar, rope, iron, steel, etc	7		₱28.00	₱28.00
Fæces	1	₱3.00		3.00
Sputum	5	15.00		15.00
Blood	5	90.00		90.00
Vaccine virus	2,000		20.00	20.00
Mallein	15		1.50	1.50
Total	2,033	108.00	49.50	157.50
Bureau of Civil Service:				
Photographic work	36		7.20	7.20
Bureau of Audits:				
Crude chemical and miscellaneous analyses	1	10.00		10.00
Bureau of Coast and Geodetic Survey:				
Photographic work	5		1.40	1.40
Bureau of Lands:				
Soils and similar substances	12	240.00		240.00
Bureau of Posts:				
Crude chemical and miscellaneous analyses	2	40.00		40.00
Philippine Exposition Board 1912:				
Photographic work	104		275.80	275.80
Bureau of Science:				
Metals and alloys	3	27.00		27.00
Rocks, minerals, natural pigments, and similar substances	24	525.00		525.00
Clays, shales, limestone, lime, wall plasters, cement, and slags	14	178.00		178.00
Fertilizers	1	4.00		4.00
Coal analyses	1	28.00		28.00
Crude chemical and miscellaneous analyses	1	5.00		5.00
Standard solutions	31	143.00		143.00
Compression, tensile, or transverse strength of concrete, stone, mortar, rope, iron, steel, etc	4	18.00		18.00
Standardization of road materials	4	22.00		22.00
Urines, clinical and toxicological analyses	10	30.00		30.00
Miscellaneous chemical analyses and examinations	7	36.00		36.00
Assays	31	57.75		57.75
Waters—				
Chemical	11	480.00		480.00
Biological	7	280.00		280.00
Photographic work	1,029	651.20		651.20
Shop work	180	1,168.16		1,168.16
Total	1,358	3,653.11		3,653.11
United States Army and Navy:				
Metals and alloys	2		14.00	14.00
Cements	59		295.00	295.00

TABLE IV.—*Showing free and cash work, etc.*—Continued.

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
United States Army and Navy—Continued.				
Compression, tensile, or transverse strength of concrete, stone, mortar, rope, iron, steel, etc	8		₱39.00	₱39.00
Paints, varnishes, and linseed oils	4		36.00	36.00
Gums, resins, and similar materials	1		7.00	7.00
Foods, alcohols, and beverages	21	₱86.00	141.00	227.00
Miscellaneous chemical analyses and examinations	15		211.00	211.00
Waters, chemical analyses	2		50.00	50.00
Vaccine virus	16,700		529.00	529.00
Mallein	565		565.00	565.00
Miscellaneous sera and preparations	563,065		1,249.00	1,249.00
Supplies	257		193.80	193.80
Total	580,699	86.00	3,329.80	3,415.80
City of Manila:				
Crude chemical and miscellaneous analyses	1		4.00	4.00
Cements	171		427.50	427.50
Compression, tensile, or transverse strength of concrete, stone, mortar, rope, iron, steel, etc	2		10.00	10.00
Standardization of road materials	5		22.50	22.50
Essential oils and essences	1		5.00	5.00
Gastric juice, clinical examinations	1		75.00	75.00
Medicines and similar articles	2		10.00	10.00
Miscellaneous biological work and examinations	1		12.00	12.00
Miscellaneous sera and preparations	56,000		56.00	56.00
Photographic work	11		3.30	3.30
Total	56,195		625.30	625.30
Provinces and municipalities:				
Coal analyses	2		30.00	30.00
Calorimetric tests of fuels	2		40.00	40.00
Crude chemical and miscellaneous analyses	1		25.00	25.00
Cements	63		157.50	157.50
Compression, tensile or transverse strength of concrete, stone, mortar, rope, iron, steel, etc	8		24.00	24.00
Standardization of units of measures—				
Weights	583		65.18	65.18
Urines, clinical and toxicological analyses	1		50.00	50.00
Medicines and similar articles	3		15.00	15.00
Vaccine virus	4,800		144.00	144.00
Photographic work	1		4.50	4.50
Shop work	1		2.30	2.30
Total	5,465		557.48	557.48
Miscellaneous:				
Metals and alloys	3		44.00	44.00
Rocks, minerals, natural pigments, and similar substances	19		72.50	72.50

TABLE IV.—*Showing free and cash work, etc.*—Continued.

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Miscellaneous—Continued.				
Clays, shales, limestone, lime, wall plasters, cement, and slags	67		₱714.44	₱714.44
Fertilizers	13		108.30	108.30
Soils and similar substances	32		731.00	731.00
Coal analyses	8		108.00	108.00
Calorimetric tests of fuels	2		40.00	40.00
Crude chemical and miscellaneous analyses	18		202.80	202.80
Cements	17		85.00	85.00
Compression, tensile, or transverse strength of concrete, stone, mortar, rope, iron, steel, etc	10		26.00	26.00
Standardization of road materials	7		33.50	33.50
Standardization of units of measures—Miscellaneous	8		42.00	42.00
Urines, clinical and toxicological analyses	74		321.00	321.00
Essential oils and essences	2		27.50	27.50
Petroleum and products, copra, and similar materials	7		78.00	78.00
Paints, varnishes, and linseed oils	13		177.50	177.50
Foods, alcohols, and beverages	579		1,678.00	1,678.00
Food preservatives and coloring matters	1		5.00	5.00
Medicines and similar articles	2		23.00	23.00
Miscellaneous chemical analyses and examinations	10		128.00	128.00
Assays	381		832.00	832.00
Waters—				
Chemical	8		185.00	185.00
Biological	7		280.00	280.00
Fæces	263		432.00	432.00
Sputum	23		69.00	69.00
Blood	63		843.00	843.00
Gonococci	2		6.00	6.00
Miscellaneous biological work and examinations	6		30.00	30.00
Vaccine virus	12,128		442.50	442.50
Mallein	21		21.00	21.00
Miscellaneous sera and preparations	442,845		724.55	724.55
Photographic work	5,388		2,901.15	2,901.15
Natural history specimens	34		91.50	91.50
Shop work	25		271.43	271.43
Supplies	523		2,225.19	2,225.19
Miscellaneous work	30		1,365.30	1,365.30
			Cash.	*Total.*
Sales of Publications			7,452.06	7,452.06
Power, gas, etc			28,766.35	28,766.35
Reimbursement of traveling expenses, etc			4,131.50	4,131.50
Refunded, work not done, etc			109.22	109.22
Total	462,639		55,824.29	55,824.29
Grand total	4,472,102⅝	₱292,593.44	₱96,634.81	₱389,228.25

TABLE V.—*Comparative statement showing expenditures (including obligations incurred) for the fiscal year 1912 as compared with the fiscal year 1911.*

Item.	Expended during the year.	Outstanding obligations on July 1, incurred during the fiscal year.	Total for the fiscal year 1912.	Total for the fiscal year 1911.	Decrease.	Increase.
Apparatus, supplies, etc.:						
Miscellaneous supplies and chemicals	₱25,094.93	₱5,236.38	₱30,331.31	₱17,658.48		₱12,672.83
Apparatus	5,840.21	12,646.56	18,486.77	12,546.17		5,940.60
Supplies for power plant, oil, coal, etc	24,120.30	3,793.01	27,913.31	22,746.29		5,167.02
Small animals, feed, etc	3,620.28		3,620.28	7,648.11	₱4,027.83	
Large animals, feed, etc	3,614.95	139.20	3,754.15	6,251.12	2,496.97	
Office supplies	2,387.76	157.26	2,545.02	1,490.17		1,054.85
Photographic supplies	2,471.28		2,471.28	2,703.37	232.09	
Books, subscriptions, etc	8,467.55	2,057.39	10,524.94	10,217.35		307.59
Total	75,617.26	24,029.80	99,647.06	81,261.06		18,386.00
Transportation and freight, etc.:						
Transportation, travel expenses, per diems, launch hire, etc	16,303.82		16,303.82	12,508.67		3,795.15
Freight	885.14		885.14	736.97		148.17
City transportation	3,236.86		3,236.86	2,969.15		267.71
Total	20,425.82		20,425.82	16,214.79		4,211.03
Miscellaneous:						
Telephones and fire alarm boxes	977.54		977.54	974.64		2.90
Postage, telegrams, and cablegrams	2,541.64		2,541.64	4,534.49	1,992.85	
Repairs to apparatus, furniture, etc	1,183.07		1,183.07	428.02		755.05
Laundry	410.00		410.00	365.04		44.96
Printing and binding	18,186.91	16,813.70	35,000.61	30,344.38		4,656.23
Advertising	961.94		961.94	1,202.84	240.90	
Incidentals, building maintenance, etc	5,234.90	9,000.00	14,234.90	8,125.96		6,108.94
Museum specimens	440.10		440.10	9,806.80	9,366.70	
Total	29,936.10	25,813.70	55,749.80	55,782.17	32.37	

Salaries and wages:						
Salaries and wages	250,099.14		250,099.14	248,886.05		1,213.09
Transportation and expenses en route foreign country to Manila	3,141.21		3,141.21	2,697.52		443.69
Accrued leave and half salary	19,520.12		19,520.12	18,899.96		620.16
Total	272,760.47		272,760.47	270,483.53		2,276.94
Grand total	398,739.65	49,843.50	448,583.15	423,741.55		24,841.60
The outstanding obligations and accounts payable of previous fiscal years unpaid on July 1, 1911, amounted to ₱39,994. During the fiscal year 1912, ₱36,603.95 was paid against this amount and the difference between estimates and actual costs and cancellations amounted to ₱2,268.08, leaving the obligations still due on previous fiscal years, ₱5,658.13	36,603.95	5,658.13				
	435,343.60	55,501.63				
Transferred to aquarium	18,000.00					
	453,243.60					
Scientific investigation and animal diseases, Act 1955:						
Available, July 1, 1911	776.86					
Reverted to Treasury	776.86					
Balance						
Aquarium, Act 1902:						
Available, July 1, 1911 ₱16,932.32						
Available by restoration 18,000.00						
Total available	34,932.32					
Expended	16,032.41					
Balance	18,899.91					
Library equipment, Act 1988:						
Available, July 1, 1911	17,500.00					
Expended	15,293.61					
Balance	2,206.39					

Appropriation account:		
Allotment, fiscal year 1912		₱340,000.00
Accounts payable, fiscal year 1911		3,777.34
Brought forward previous fiscal year to cover outstanding obligations		36,216.66
Restoration of reverted balance		18,000.00
Receipts from operation		96,634.81
Total		494,628.81
Expended, as shown above	₱435,343.60	
Contingent obligations	55,501.63	
Transferred to other account	18,000.00	
Credits	(14,216.42)	
		494,628.81
Reverted to Treasury		
Pests eradication, Act 2178:		
Available, March 16, 1912		10,000.00
Expended		9,963.28
Reverted to Treasury		36.72
Library fund, Act 1416:		
Available, July 1, 1911		128.86
Expended		124.42
Balance		4.44

ILLUSTRATIONS

INDEX

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TO THE HONORABLE
THE SECRETARY OF THE INTERIOR

BY

ALVIN J. COX
ACTING DIRECTOR OF THE BUREAU OF SCIENCE

FOR THE YEAR ENDING
AUGUST 1, 1912

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